# MECHANICAL ENGINEERING

August 1961

**ANNUAL REVIEW**

A Review of Heat Transfer Literature 1960, 50

Part Two: CONVECTION FROM ROTATING SURFACES • COMBINED HEAT AND MASS TRANSFER • CHANGE OF PHASE • RADIATION • LIQUID METALS • LOW-DENSITY HEAT TRANSFER • MEASUREMENT TECHNIQUES • HEAT TRANSFER APPLICATIONS • THERMODYNAMIC AND TRANSPORT PROPERTIES


ASME: A Critical Look, 38

Measuring Millionths, 40

Plasma-Torch Cutting, 43

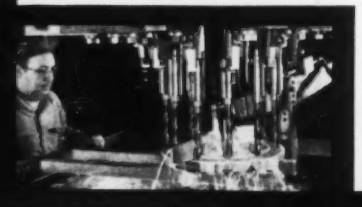
Patents and the Engineer, 47

Lightweight Armor Plate

# The Source for Better Service . . . a Better Product

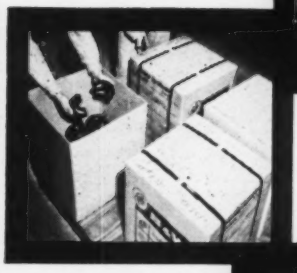
# B&W's New Fittings Plant is in FULL OPERATION

One of the mill stock bays.

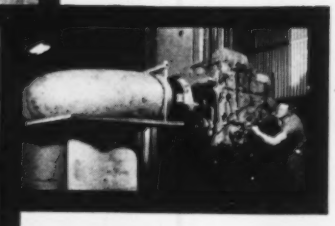


Machining a B&W flange.

Forging a tee.



Packing fittings for shipment.



Machining a 24″ elbow

The paint line.

The transfer of B&W's welding fittings operations from Milwaukee to Beaver Falls is now complete. In full operation is the newest, most modern source for welding fittings and flanges in the industry. In full operation is a welding fittings plant that is integrated with B&W's facilities for steel and tube-making.

In terms of practical benefits to you, this means:

- You can get a complete line of welding fittings and flanges, quality controlled at every step of the production process from melt to the finished product.
- You can get a complete process piping package . . . welding fittings, flanges and tubular products from a single source . . . job-matched to end-use service.
- You can more effectively coordinate and control specifying, buying and delivery from one manufacturer.
- You can get on-time deliveries because complete integration permits flexible production schedules, particularly in the specialized steels.

For further details on how B&W's new fittings plant with its integrated facilities and services can help you, contact any of the local B&W District Sales Offices or write The Babcock & Wilcox Company, Tubular Products Division, Welding Fittings Plant, P.O. Box 230, Beaver Falls, Pennsylvania.

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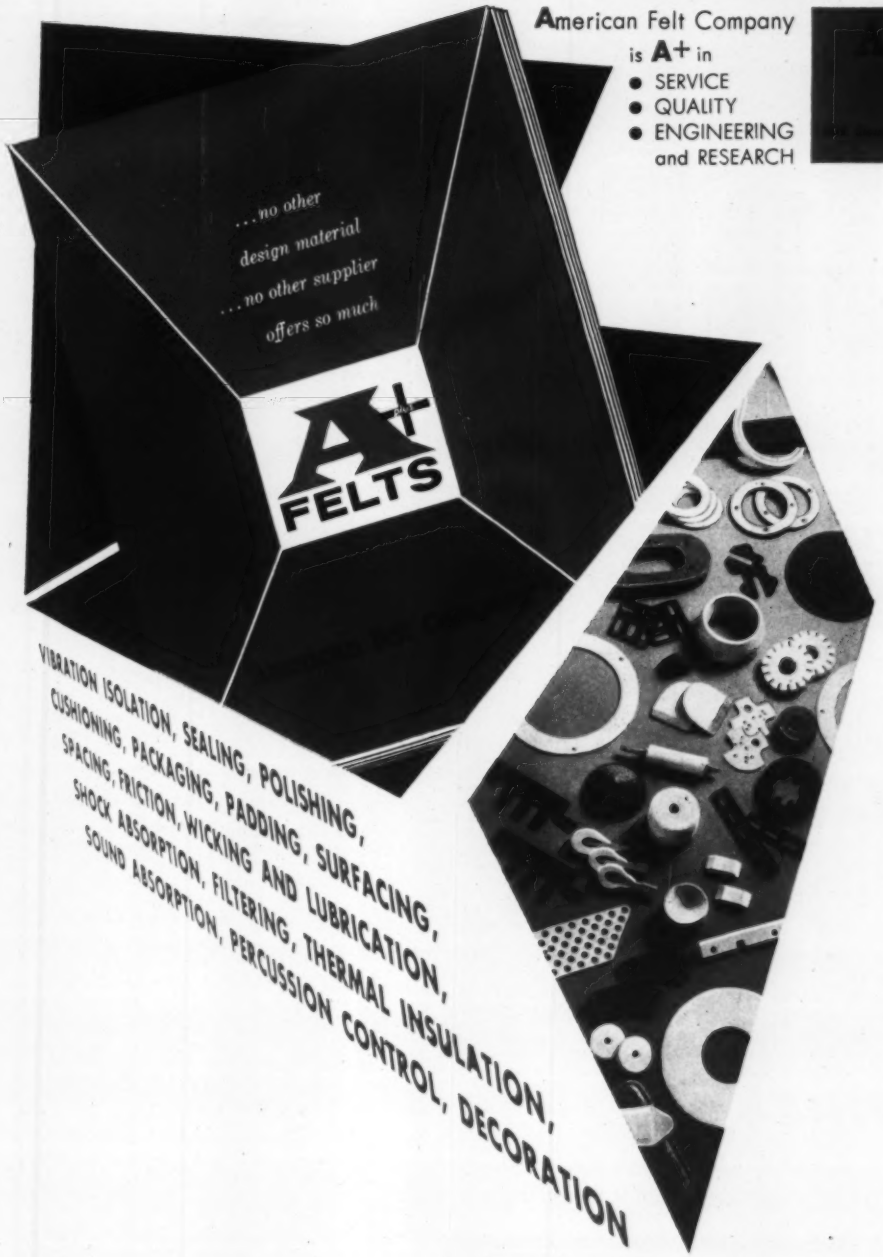


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# Contents

VOLUME 83 • NUMBER 8 • AUGUST, 1961

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**THE COVER**

That's the "hot side" of an armor-plate sample after it has soaked up a 37-mm high-explosive shell. What makes it news? The plate is aluminum alloy and the shell, fired at a weld, did not penetrate. Thus aluminum, by Aluminum Company of America, passed the last of a series of ballistic tests to prove its capability for armored vehicles. It is, of course, light, easy to fabricate, corrosion resistant. Man holding the shell is David Witt, Ordnance Section, Proof and Development Section, U. S. Army, Aberdeen Proving Ground.

**ASME: A CRITICAL LOOK**.....**W. H. Byrne** 38

Now hear this: The Society has a report from a firm of consultants, telling us where we fall short, showing us ourselves as others see us. President Byrne reports on possible changes in our operation.

**MEASURING MILLIONTHS**.....**National Bureau of Standards** 40

The "gage block" is the basis of accurate measurement in industry. To check your blocks, the National Bureau of Standards uses master blocks, some of which expand only 0.0000002 in. per in. per year.

**PLASMA-TORCH CUTTING**.....**J. A. Browning and G. A. Klasson** 43

Do you have a picture of what happens in arc-plasma cutting? Here is basic plasma information—the theory, methods employed, types of equipment, cost comparisons. Economies can be startling.

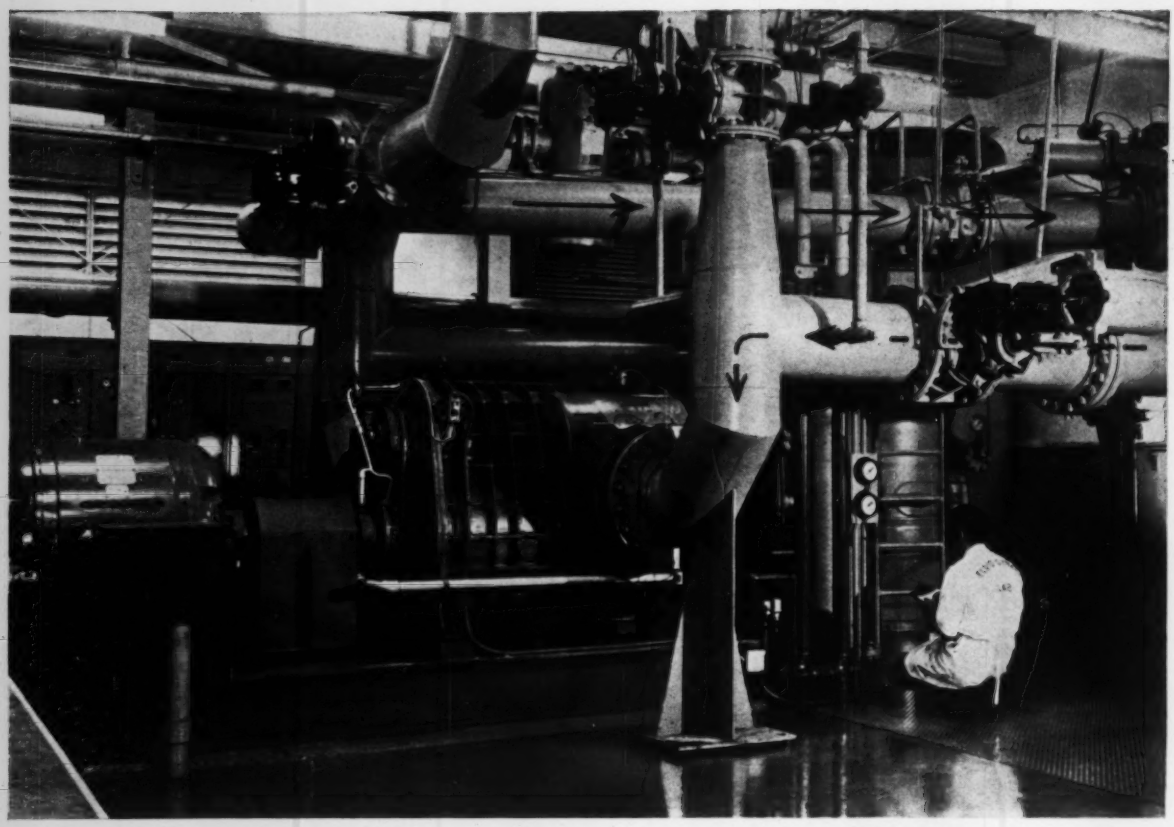
**PATENTS AND THE ENGINEER**.....**Alfons Puishes** 47

Let's get together. Engineering and patents are indispensable to each other. The patent system needs the engineer's good right hand in its support; and one of these days, this could mean you.

**A REVIEW OF HEAT TRANSFER LITERATURE 1960—Part 2** 50
...**E. R. G. Eckert, T. F. Irvine, Jr., E. M. Sparrow, and W. E. Ibele**

Inch by inch, the theories are tested against experimental results, experiment checked with reality. Nowhere does the engineer face so many variables as in the prediction of heat transfer.

Contents continued on following page



# PRESSURE or VACUUM

## The Ingersoll-Rand *Axi-compressor* provides both in a single, compact, versatile unit

USED for flight simulation at a large aircraft research center, the Ingersoll-Rand Axi-compressor shown above does double duty, serving either as a compressor or an exhauster. By switching of intake and discharge valves, it can provide up to 12,250 cfm of wind-tunnel air at 5 psig, or pull vacuums of up to 24″ Hg at correspondingly high capacity.

The Axi-compressor is a positive displacement, axial-flow machine which operates by the action of two intermeshing helical rotors turning at high speed. The rotors do not touch each other or the sides of the casing—hence there is no mechanical wear and no lubrication is needed, providing a smooth flow of *oil-free* air or gas. More compact than other units of equivalent pressure and capacity, it saves both floor space and head room and can often be installed where no other compressor or vacuum pump would fit.

Type L Axi-compressors are available in 29 basic sizes, with capacities from 100 to 12,000 cfm and pressures to 15 psig or vacuums to 24″ Hg. Ask your Ingersoll-Rand engineer for complete information, or send for a copy of Bulletin 11,003.

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# Contents (continued)

VOLUME 83 • NUMBER 8 • AUGUST, 1961

## Departments

EDITORIAL ..... 37

BRIEFING THE RECORD ..... 58

Industry Goes Underground 58
Niagara Hydro Plant 59
Precision Parts Measured 59
Vacuum-Degassed Steel 60
Desalination 60
"Clam-Shell" Arc-Imaging Furnace 61
Combination Auto-Suspension System 61
Multistation Computer 61
Audio-Visual Aids Speed Assembly 62
Services Versus Production 62
High-Temperature Burner 63
Plastic Packaging 63
Seawater Plant in Operation 64
Water-Jet-Powered Precipitator 64
Near-Absolute-Zero Refrigerator 65
Computers Aid Researchers 65
Railroad Communications System 66
Stainless-Steel Hopper Car 66
Nuclear Briefs 67
Materials Briefs 67
Pneumatic-Hydraulic Tool Control 68
Speech Is Synthesized 68
Oxygen-Blown Chrome Refining 69
D-C Transmission by 1985? 69
Coal Research 69

PHOTO BRIEFS ..... 70

EUROPEAN SURVEY ..... 72

ASME TECHNICAL DIGEST ..... 74

Maintenance and Plant Engineering 74
Lubrication 76
Aviation 79
Oil and Gas Power 80
Gas Turbine Power 83
Textile Engineering 84
ASME Transactions for July, 1961 85

COMMENTS ON PAPERS ..... 86

REVIEWS OF BOOKS ..... 87

BOOKS RECEIVED IN LIBRARY ..... 88

ASME BOILER AND PRESSURE VESSEL CODE ..... 89

THE ROUNDUP ..... 92

ASEE Meeting 92
Education 93
Meetings of Other Societies, 100
Literature 97
People 98

THE UNITED ENGINEERING CENTER ..... 101

THE ASME NEWS ..... 102

ASME Professional Divisions Decentralize 102
JAC Conference 104
APM Summer Conference 104
Business Meeting 105
ASME Summer Annual Meeting 106
1961 RAC Meetings 110
ASME Officers Nominated 112
ASME 1962 National Nominating Committee Organizes 118
ASME Coming Events 119
Joint Engineering Management Program 120
Petroleum Conference Program 120
National Power Conference Program 121
Report on ASME Research 122
Process Industries Conference Program 123
Joint Solid Fuels Conference Program 124
ASME Elects Five Fellows 124
Junior Forum 127
Personnel Service 129
Candidates 131
Obituaries 131

KEEP INFORMED ..... 135

CLASSIFIED ADS ..... 163

166 ..... CONSULTANTS

168 ..... ADVERTISING INDEX

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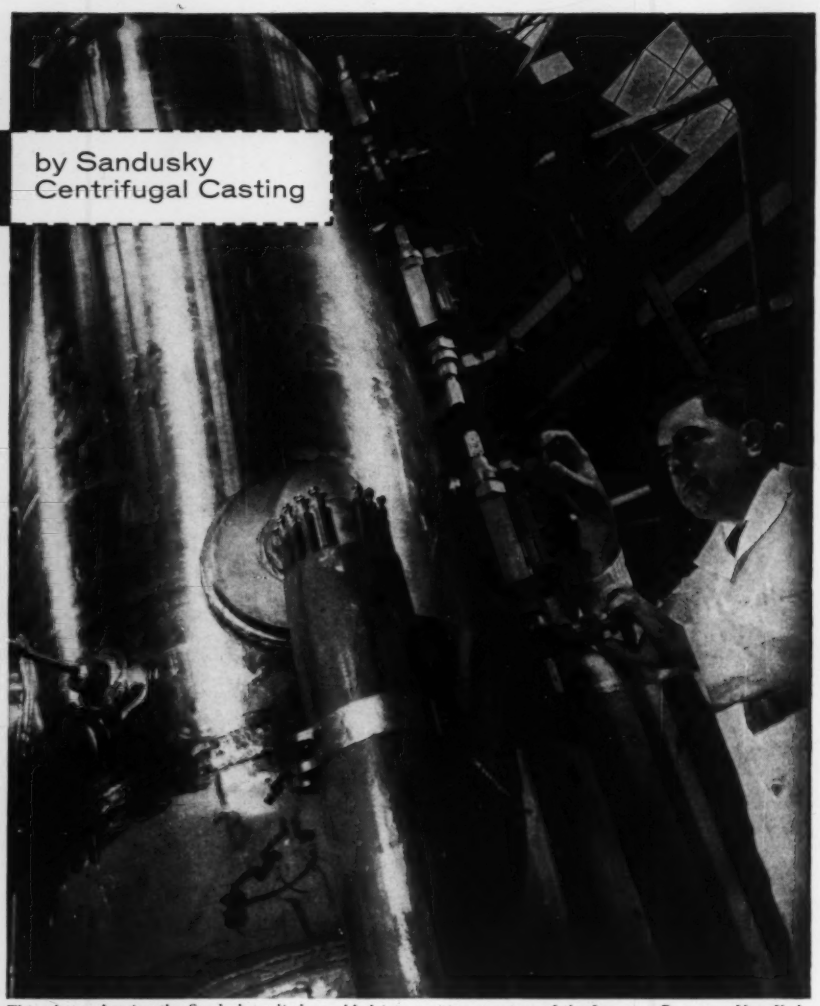
**SOLVED:** by Sandusky Centrifugal Casting



This photo, showing the Sandusky cylinder welded into position, courtesy of the Lummus Company, New York. New York who fabricated, assembled and tested the completed loop before shipping it to the ETR site in Idaho.

## Nuclear Test Loop Uses Sandusky Centrifugal Casting as Pressurizer Cylinder

A Sandusky Centrifugal Casting is the main cylindrical component of an electrically heated pressurizer, designed by Knolls Atomic Power Laboratory to Section VIII, of the ASME Code (Unfired Pressure Vessels) for use in the new Engineering Test Reactor facilities at Idaho Falls, Idaho.

This 66¼" long cylinder, 27" O.D. with walls 2½" thick, was centrifugally cast of an 18-8 stainless steel (SA-351, Grade CF-8) for the extra corrosion resistance required under nuclear loop service conditions: demineralized water at temperatures to 650°F and pressures to 2500 PSI.

O. G. Kelley Co., Boston, to whom we delivered this 2-ton, fully machined cylinder, welded on the forged heads and nozzles, radiographed the welds, and hydro tested the completed vessel to 4300 PSI.

This is another example of the adaptability of Sandusky Centrifugal Castings to applications demanding the highest order of quality. They may well offer you a practical and economical answer to your cylindrical needs, also.

We are producing cylinders and piping in diameters from 7" to 54"—in lengths to 33 ft.—in a wide range of ferrous and non-ferrous alloys. Write for Bulletin 300, for more complete technical information on the Sandusky process and product application data.

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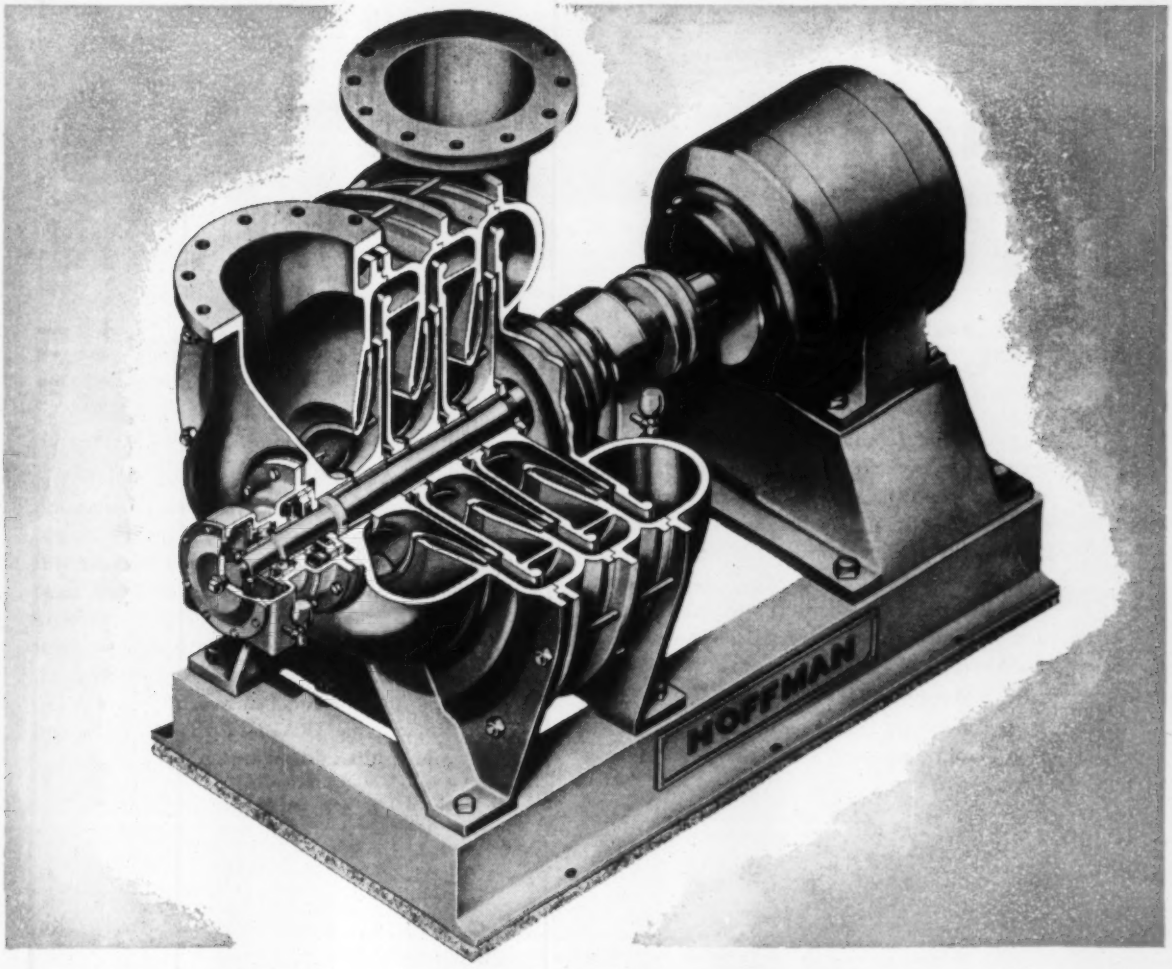


# HOW TO GIVE YOUR PRODUCTION PROBLEMS THE AIR

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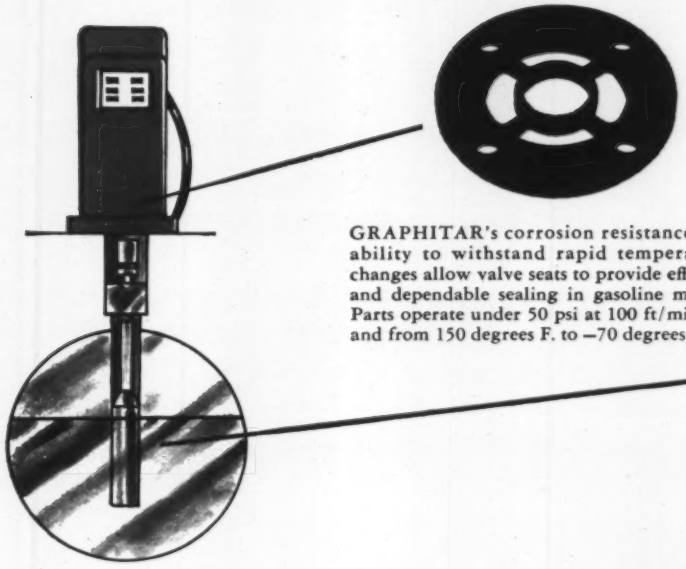
Superior performance and unusually long service life, even in tough applications, is practically second nature to parts made of GRAPHITAR. That's because they combine GRAPHITAR's chemical stability, heat resistance, low coefficient of friction, adaptability to self-lubrication, mechanical strength, hardness and light weight. An everyday application of GRAPHITAR that illustrates well its versatility and remarkable performance can be found in the face-type valves employed in bulk station gasoline meters.

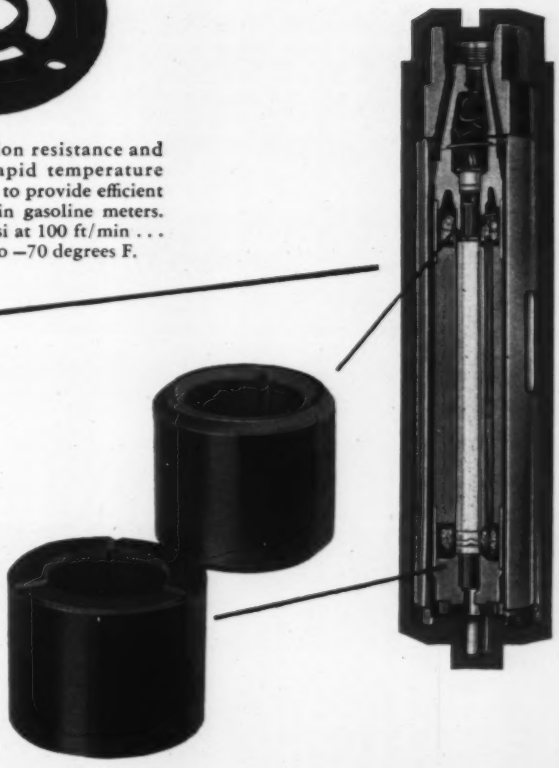
These valves incorporate GRAPHITAR seats. Here, GRAPHITAR's corrosion resistance, chemical inertness and resistance to expansion or contraction under rapid temperature changes, allow the valves to provide a leak-tight seal with excellent wear characteristics. These same characteristics are necessary for good performance wherever steam, gas and chemicals must be handled under the most adverse conditions. Perhaps your product can benefit from the top performance of GRAPHITAR, a unique and versatile engineering material.

Comparative testing of various grades of GRAPHITAR self-aligning seals is accomplished on this equipment, which duplicates actual operating conditions. GRAPHITAR rotary pressure joint seals such as these often operate at 400 psi, at 650°F. and at rotary speeds of 600 ft/min.

Tests show that the compressive strength of GRAPHITAR grades varies from 4,500 to 45,000 psi. Correct part design can take advantage of this desirable characteristic to aid part performance.

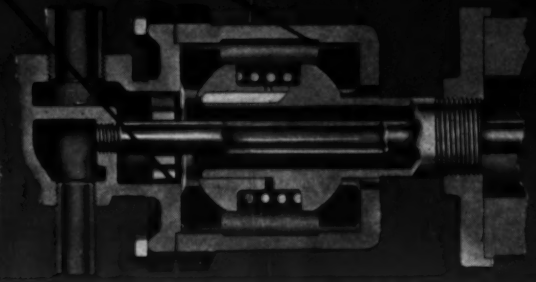


GRAPHITAR's corrosion resistance and ability to withstand rapid temperature changes allow valve seats to provide efficient and dependable sealing in gasoline meters. Parts operate under 50 psi at 100 ft/min . . . and from 150 degrees F. to —70 degrees F.



Running directly in the gasoline reservoirs below ground level, a submersible, explosion proof pump depends on two GRAPHITAR bearings to keep its operation safe and smooth. GRAPHITAR is non-metallic, will not weld or score even when in contact with a dry metal shaft. Because GRAPHITAR operates with *any* liquid as a lubricant, it is an ideal bearing material wherever low viscosity liquids such as gasoline are encountered.

Self-aligning seals of GRAPHITAR are employed in rotary pressure joints handling steam, water, hot oil, trichlorethylene, powdered talc and a variety of chemicals. GRAPHITAR has the ability to withstand the action of many such chemicals and only very highly oxidizing reagents in hot and concentrated form can react to destroy GRAPHITAR.



GRAPHITAR is a material uniquely designed by its nature for solving tough problems and improving processing, and it can be further custom-engineered to meet your exact specifications. For complete information on GRAPHITAR . . . send for Engineering Bulletin #20.

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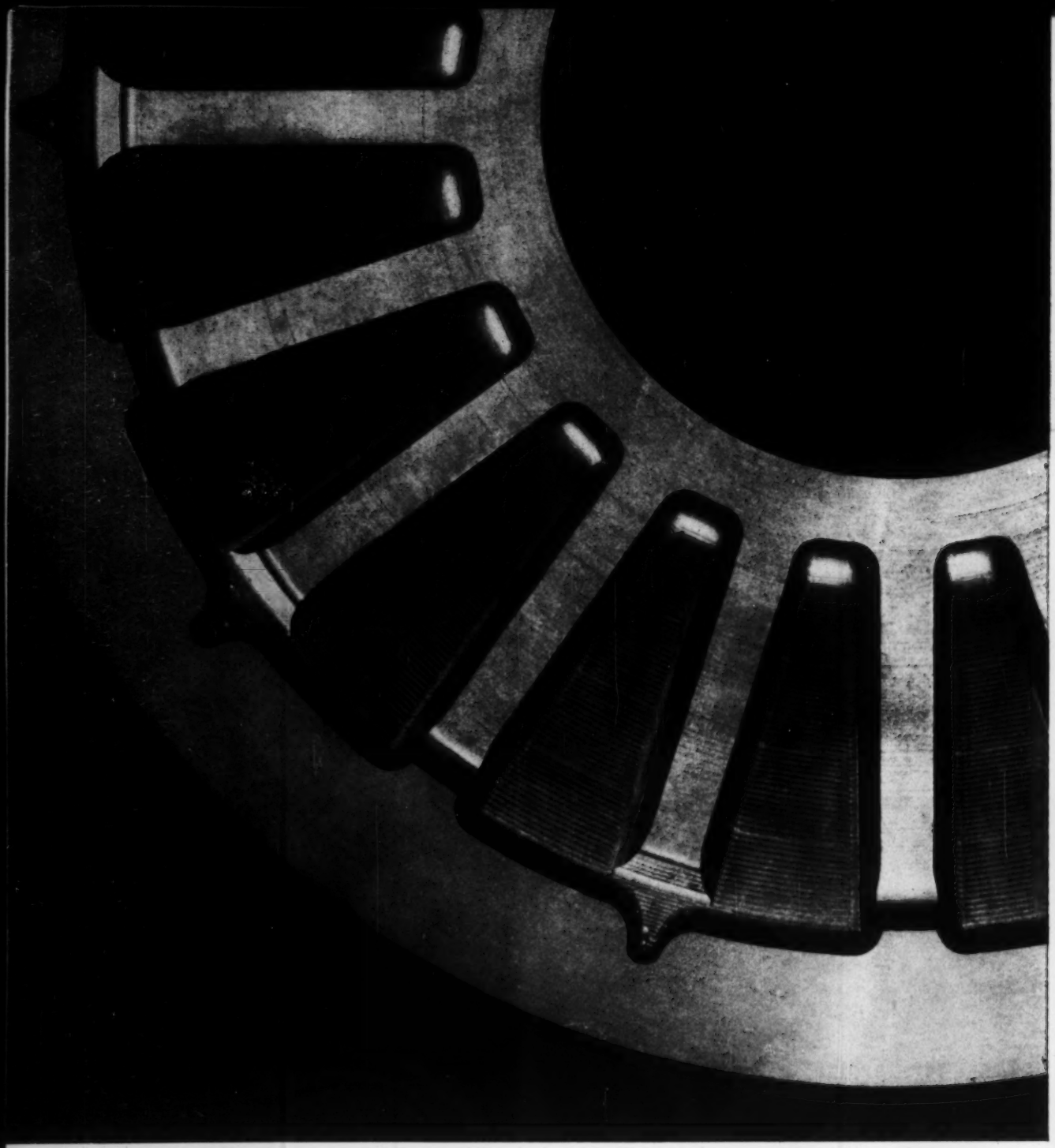
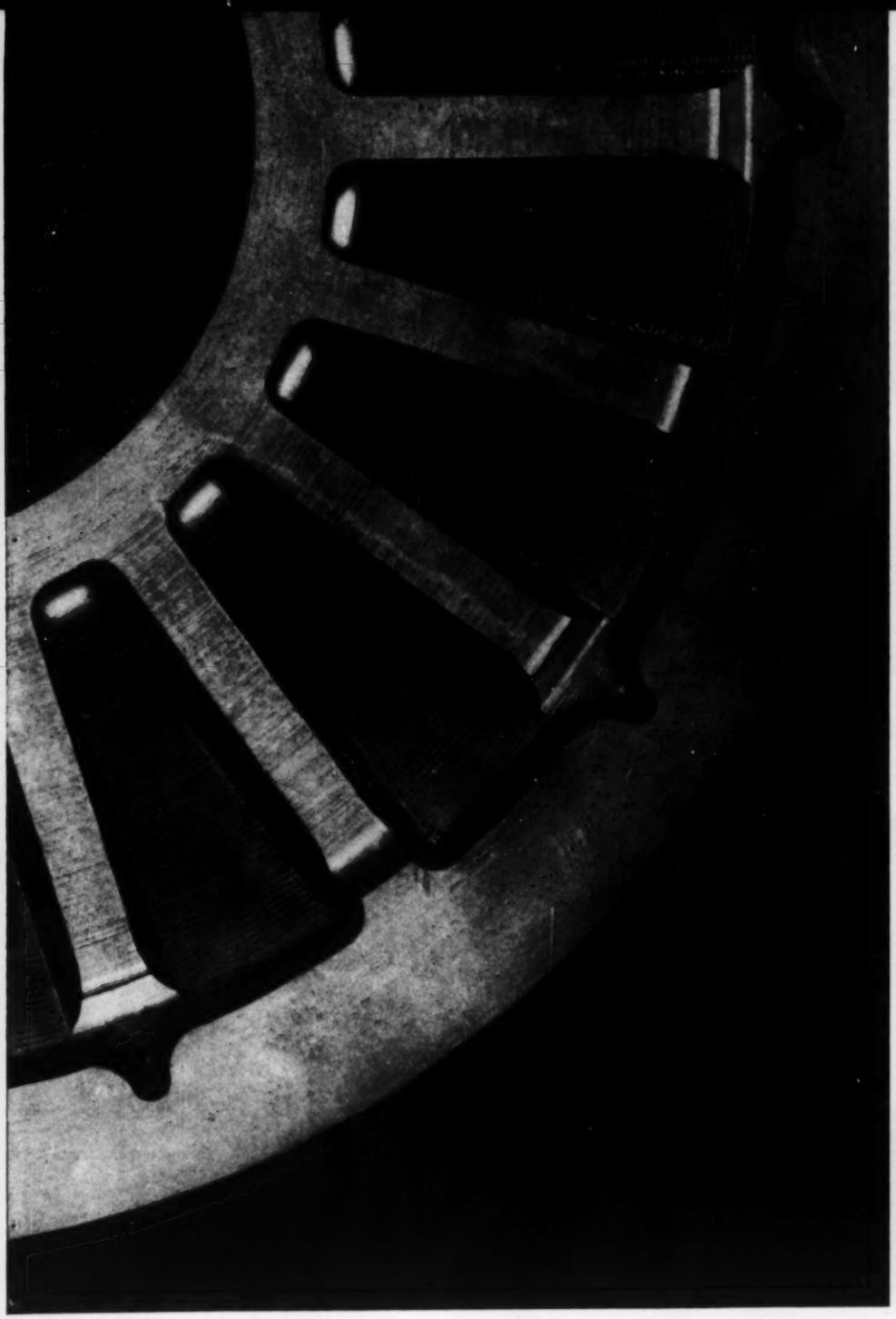


# New IBM computer language...AUTOPROMT cuts milling time for this helicopter gearbox cover by 75%

AUTOPROMT (AUTOmatic PROgramming for Machine Tools) is a powerful new computer language designed to broaden the use of numerically-controlled machine tools.

AUTOPROMT, for the first time, lets an engineer *describe the surfaces* of the three-dimensional shape he wants milled, *rather than calculating every path* the tool must follow in order to machine the part.

AUTOPROMT leaves to the computer the task of automatically generating these tool paths. You describe the part to be milled and the tool to be used in simple, *English-like*



terms. The computer does the laborious calculating work.

AUTOPROMT produces results like these: the time to mill the gearbox shown in the photographs cut to *one-fourth* the machine time required by conventional methods. AUTOPROMT reduced the lead time from blueprint to production *from three months to two weeks.*

AUTOPROMT is available to IBM customers. Call your local IBM Representative for complete details on this latest advance in Numerical Control of machine tools.

IBM®
DATA PROCESSING

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## Here's the way AUTOPROMT works at United Aircraft Corporation

The Parts Programmer, using a conventional blueprint, prepares 180 one-line statements in AUTOPROMT language.

The statements are punched into standard IBM cards and entered into the IBM 7090 Data Processing System. (AUTOPROMT also works with the 704 and 709 Systems).

The 7090, programmed with AUTOPROMT, produces 8000 tool path instructions needed to direct the Pratt and Whitney Co. Inc. Numeric-Keller Continuous Path Milling Machine.

Punched tapes direct the Numeric-Keller Milling Machine.

The Numeric-Keller mills the helicopter gearbox cover.

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One reason why power piping systems manufactured by Kellogg are unequalled anywhere for quality is that each and every section of the system is painstakingly engineered by Kellogg before manufacture.

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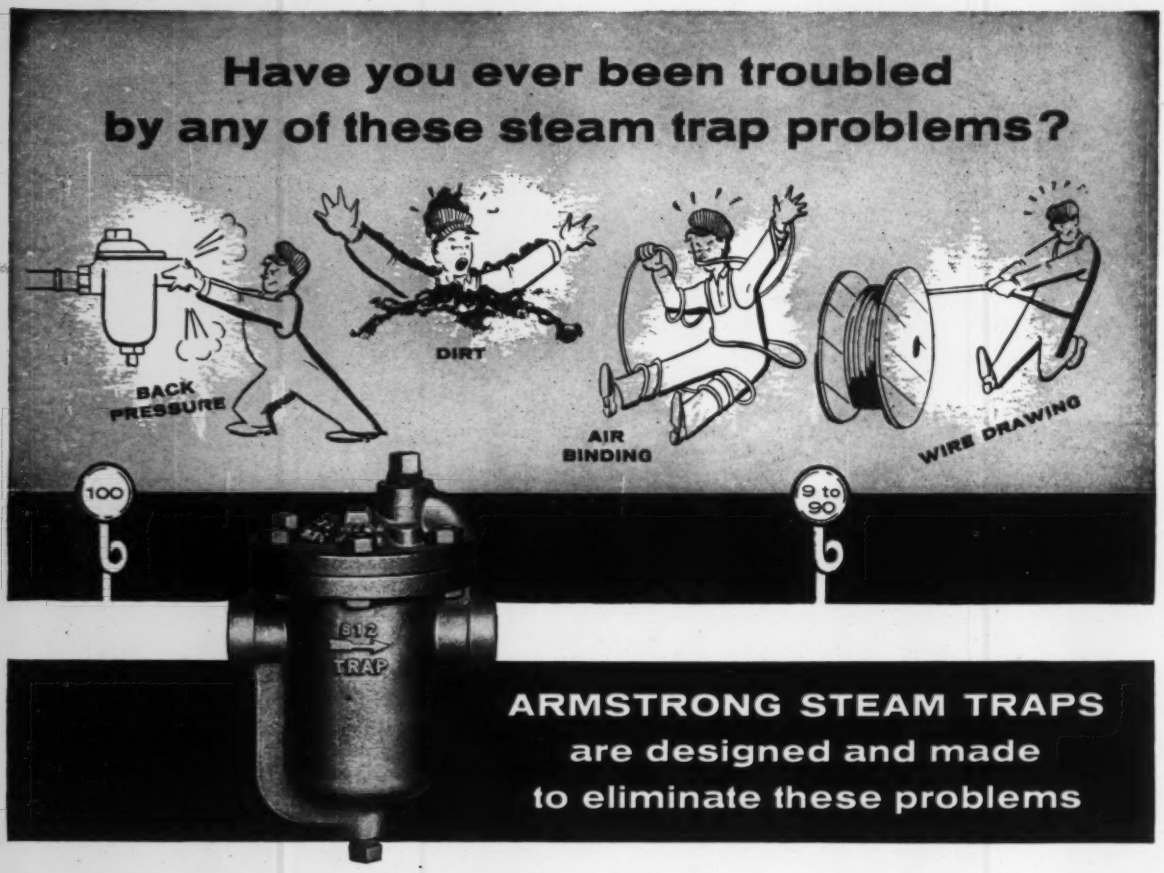
**POWER PIPING**

M KELLOGG W

**HEADQUARTERS**

# Have you ever been troubled by any of these steam trap problems?




## ARMSTRONG STEAM TRAPS are designed and made to eliminate these problems

**BACK PRESSURE** . . . Armstrong Traps operate on any back pressure—or vacuum, for that matter. As long as there is a pressure differential across the trap, it will close on steam and open for condensate. Even the high back pressure caused by blow through of one or more traps in the system will not disturb Armstrong Traps. Other than a reduction in capacity, Armstrong Traps are unaffected by back pressure.

**DIRT** . . . Armstrong Traps are not affected by ordinary dirt. When the trap opens condensate swirls down under the edge of the bucket and up through the discharge orifice. Dirt is kept in suspension and discharged along with the condensate. For very bad dirt conditions, Armstrong offers traps with integral strainers. These cost less than a trap plus a separate strainer.

**AIR BINDING** . . . Armstrong Traps cannot air bind. Air in the system passes through a vent in the top of the bucket. It collects in the top of the trap and is discharged with the condensate. There is no chance for it to stop the trap. For low pressure on-and-off units where large amounts of air accumulate while the steam is off, Armstrong offers open float and thermostatic air vent traps in a complete range of sizes.

**WIRE DRAWING** . . . Armstrong Traps are designed and made to resist wire drawing. The valve and seat are tough stainless steel. The valve opens and closes tightly with a fast action and is always water sealed. There is virtually no chance for grit or sediment to lodge in the valve, virtually no chance to create conditions that lead to wire drawing.

*There's no need to accept any of these problems as "inevitable." Your local Armstrong Representative can show you how to end them all. Call him today or write direct.*

860 Series for low pressure heating service.

800 Series, side inlet, side outlet.

No. 801, side inlet, bottom outlet.

880 Series, integral strainer.

200 Series, bottom inlet, top outlet.

Forged Steel Series for high pressures, high temperatures.

The 48 page Armstrong Steam Trap Book tells how to correctly size, install and maintain steam traps for any pressure, any temperature, any load plus full catalog data on Armstrong Steam Traps. Ask for Catalog K.

**ARMSTRONG MACHINE WORKS**

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*"See our catalog in Sweet's Plant Engineering File"*

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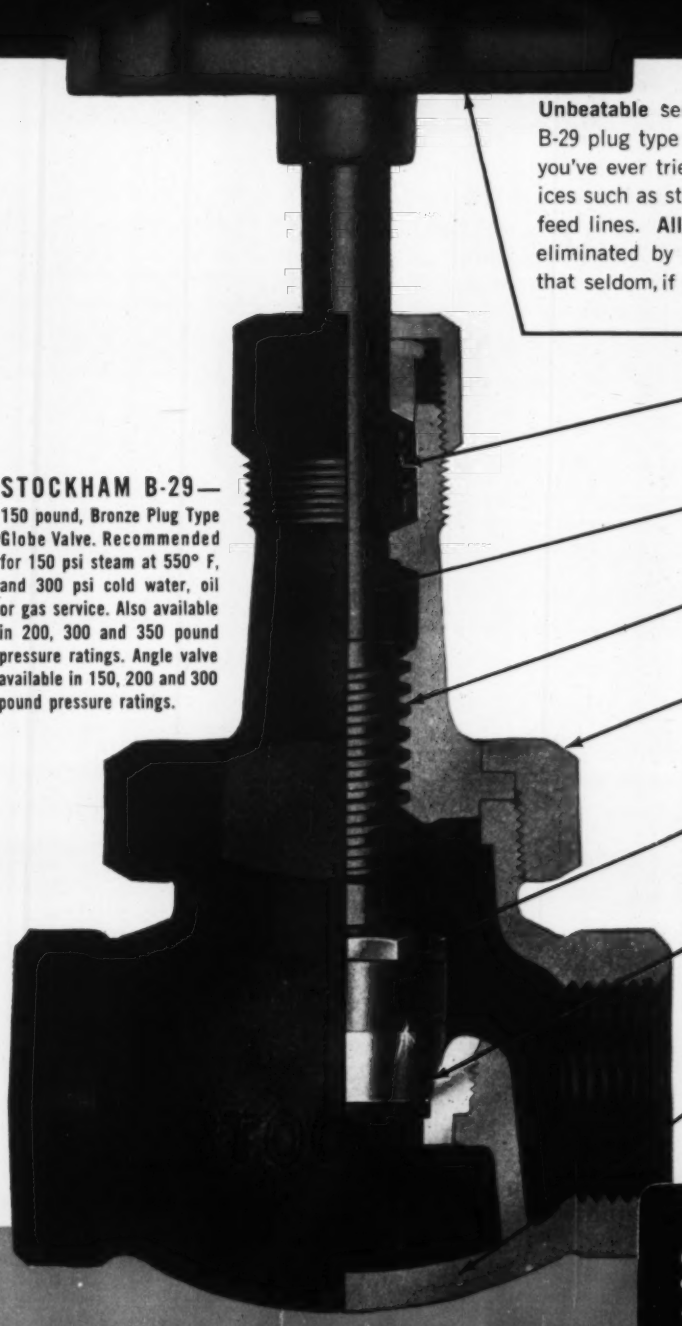
# TRY ONE ON YOUR TOUGHEST SERVICE

## and discover what dependability means...



**Unbeatable** service is built into **every** feature of Stockham's B-29 plug type bronze globe valve. It will **far outlast** any valve you've ever tried... even in the most severe valve-killing services such as steam throttling, drain or blow-off lines and boiler feed lines. **All** the common causes of valve failure have been eliminated by amazingly superior alloys and design features that seldom, if ever, need maintenance of any kind. Examples...

**STOCKHAM B-29—**
150 pound, Bronze Plug Type Globe Valve. Recommended for 150 psi steam at 550° F, and 300 psi cold water, oil or gas service. Also available in 200, 300 and 350 pound pressure ratings. Angle valve available in 150, 200 and 300 pound pressure ratings.

**HANDWHEEL**
Easy grip, non-slip, non-heating.

**STUFFING BOX**
Extra deep design, completely machined, accommodates more packing for tighter seal, longer packing life and less repacking. Can be repacked under pressure in full open position.

**BESTALOY STEM**
Extra large diameter aluminum-silicon bronze alloy stem is by far the longest wearing in the industry.

**STEM THREAD ENGAGEMENT**
Extra heavy acme stem threads and complete stem thread engagement assure maximum stem life.

**UNION BONNET**
Rugged, heavy duty body-bonnet connection, best type to resist line strain and give added strength for severe operating conditions. Easiest type to dismantle and reassemble, without danger of injury to body-bonnet bearing surfaces.

**DISC LOCKNUT**
Made of hardened stainless steel, far superior to bronze. Highly resistant to abrasive wear caused by disc rotation; offers maximum corrosion resistance.

**STAINLESS STEEL PLUG TYPE DISC & SEAT**
Heat treated to 500 Brinnell hardness for maximum resistance to galling, abrasion or wire drawing. Can be reground or renewed. Tapered plug type design best for steam throttling and close regulation. Far superior to flat type disc design.

**BODY**
Designed for minimum pressure drop. Extra heavy ribbed design gives maximum resistance to line strain.

**STOCKHAM**
**VALVES *and* FITTINGS**

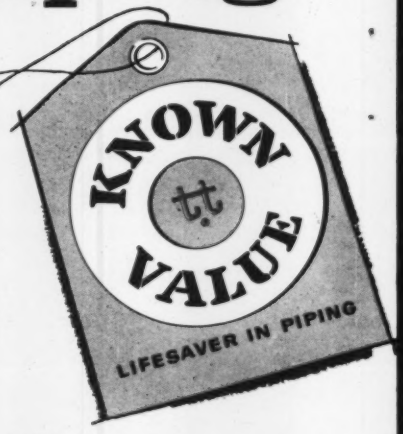
**STOCKED BY YOUR LOCAL STOCKHAM DISTRIBUTOR**

Bronze, Cast Iron, Ductile Iron, Cast and Forged Steel Valves — Wedgeplug Non-Lubricated Plug Valves — Cast Iron, Malleable and Ductile Iron Pipe Fittings

General Offices and Plant
4000 10th AVENUE, NORTH • BIRMINGHAM, ALABAMA

Circle No. 182 on Readers' Service Card

# CUT process piping COSTS with PIPE-MATE...




**Industry's most versatile line of lightweight stainless steel pipe fittings and flanges**

With the ever increasing use of low cost, lightweight stainless steel pipe in modern corrosion resistant process piping systems, has come the most logical preference for PIPE-MATE fittings and flanges. First, PIPE-MATE fittings provide a new versatility in piping fabrication that lets you choose the pipe-to-pipe and pipe-to-fitting joining method best suited to your job. Second, PIPE-MATE lightweight stainless steel fittings are available in every needed form and size from ½" to 4", in Schedules 5S and 10S.

PIPE-MATE fittings can be butt welded with either metallic arc or shielded inert gas welding techniques. Or, employing the PIPE-MATE aligning connector they can be fillet welded, brazed or silver soldered for permanent, leak-proof joints. PIPE-MATE aligning connectors eliminate costly misalignment errors, too. The entire piping system can be "pre-fitted" and adjusted for misalignment before a single joint is made up.

PIPE-MATE rolled-in flanged connections provide the perfect means for installing process piping systems when welding equipment is unavailable, when hazardous conditions dictate flameless fabrication, or when rapid system assembly and dis-assembly are required. PIPE-MATE rolled-in flanged joints are remarkably easy to make . . . no special skills or costly tools are needed. Extra long tangents on all PIPE-MATE fittings assure adequate flange clearance, and the rotatable flange makes bolt hole alignment easy.

Get all the facts today, and see how lightweight stainless steel piping and PIPE-MATE fittings can cut your process piping system costs. Write for Bulletin TT944-H205. TUBE TURNS, Louisville 1, Kentucky.

"PIPE-MATE" and "tt" T.M. Reg. U.S. Pat. Off.

# TUBE TURNS

*Division of* CHEMETRON *Corporation*

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Stub Ends

Concentric Reducers

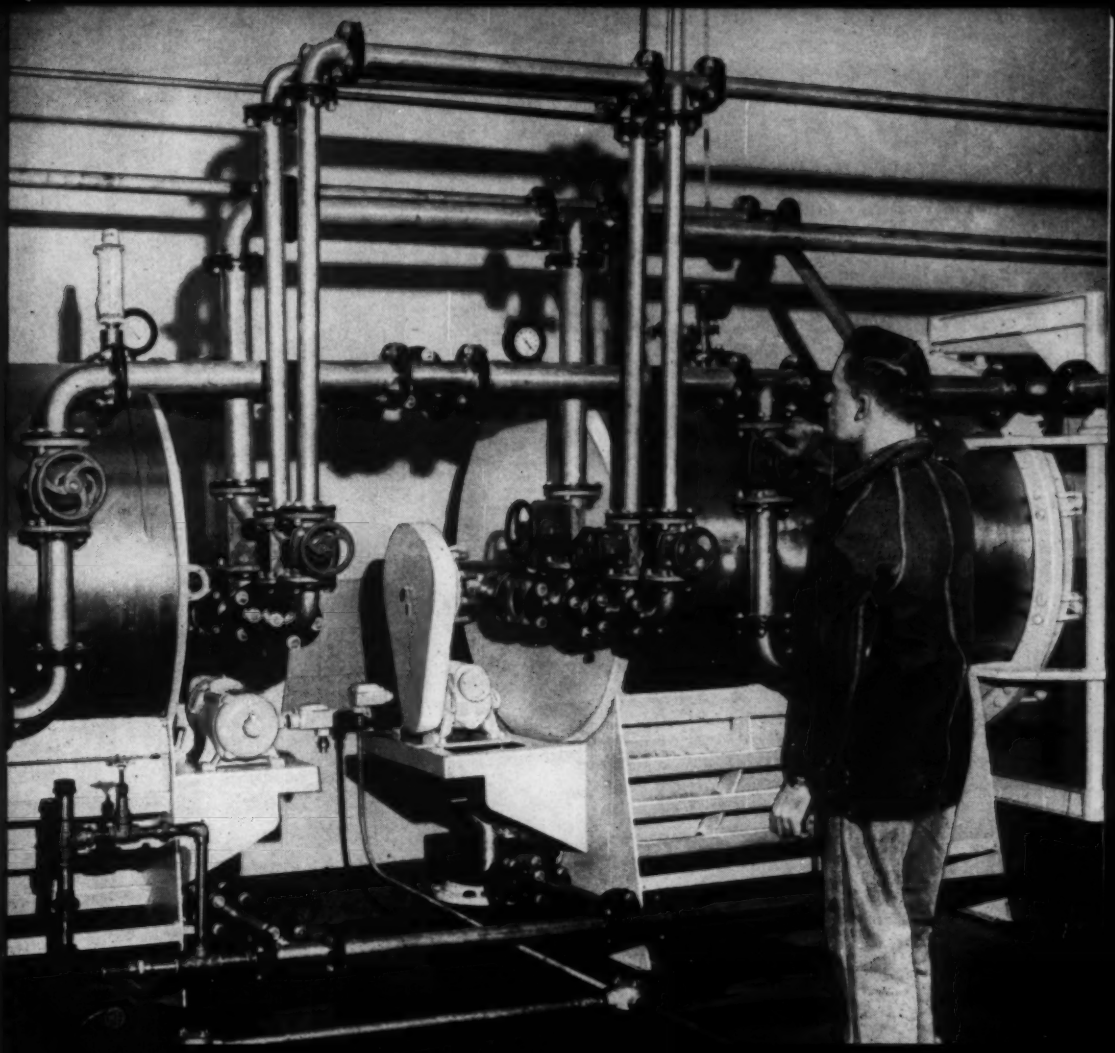
Crosses

Insert Flanges

90° Elbows

Eccentric Reducers

45° Elbows



Lightweight stainless steel process piping systems fabricated with PIPE-MATE rolled-in flanged connections cost less to install and save up to 50% in pipe costs, too.

for butt welding . . .

for fillet welding . . .

for rolled-in flanges

PIPE-MATE fittings are stocked by and sold exclusively through authorized Tube Turns Distributors

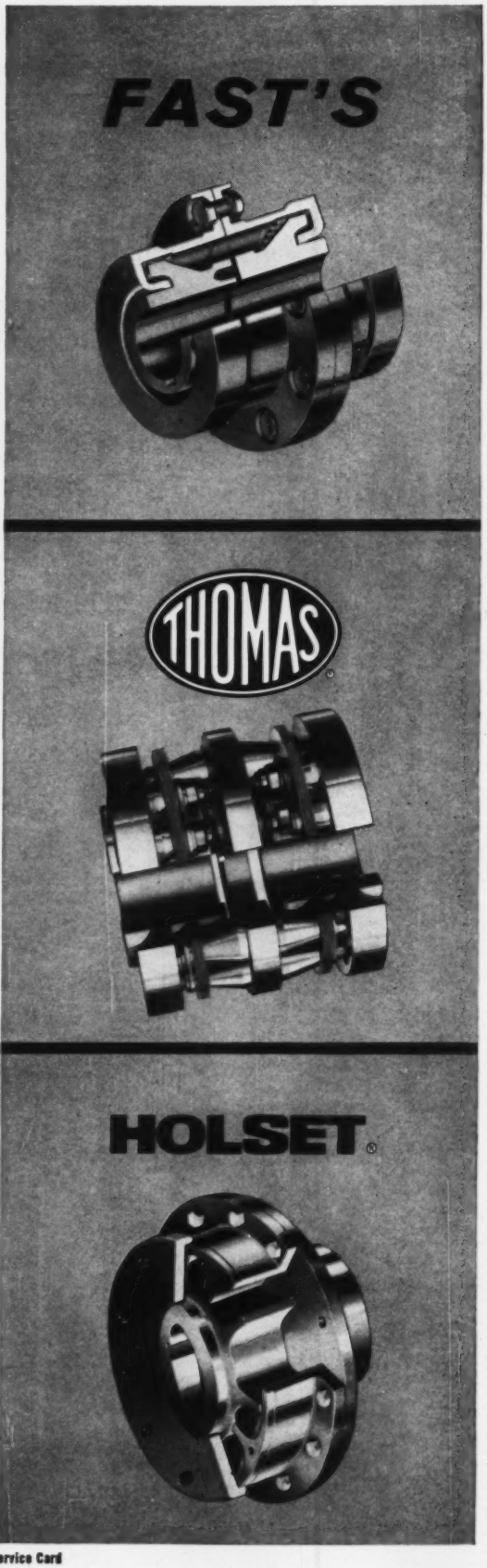
# Three great names in couplings

# NOW CARRY THIS CORPORATE SYMBOL

KOPPERS®

With the acquisition of the Thomas Flexible Disc Coupling line, Koppers now provides engineering solutions to a wide range of industrial coupling problems. Need a lubricated gear-type coupling for transmitting high loads? Koppers world-famous Fast's coupling line does the job on shafts up to 32 inches. Need a maintenance-free flexible-disc coupling with no backlash? The highly engineered Thomas line holds the answer—with miniature couplings as small as 1/12th of an ounce. Need a coupling to absorb impact or vibration? The Holset line of resilient, non-lubricated couplings protects equipment in most diesel, compressor and shock load applications.

Because each of these coupling lines has its particular application in industry . . . and because each is a recognized name in the power transmission field . . . you can continue to buy them by brand—just as you have in the past. Of considerable importance are the experienced, extensive engineering and manufacturing services of the entire Koppers organization that are available to help you with your power transmission problems . . . in any size, in any quantity, for any use.




**KOPPERS COMPANY, INC.**
COUPLING DEPARTMENT
Baltimore, Md. • Warren, Pa.
Engineered Products Sold with Service

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Consulting Engineers: H. M. WILSON CO., INC., Philadelphia 30, Penna.

# FOUR KEELER TYPE MKL STEAM GENERATORS EXCEED EFFICIENCY GUARANTEE AT SEARS

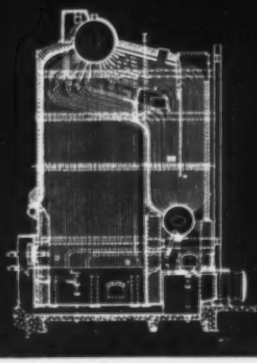
The Sears, Roebuck and Co. mail order plant in Philadelphia encompasses millions of square feet of usable space. The entire steam requirement plus adequate standby is supplied by four quick-response Keeler Type MKL Steam Generators installed in a recent modernization.

Test results have exceeded the guarantee of efficiency and their operation has been *"most satisfactory"!* The new MKL's are 40,000 lb stm/hr combination oil-gas, custom-designed units, 175 psi operating pressure. They were installed in the space previously occupied by four of the six 500-hp boilers which they replaced.

The space and versatility advantages experienced at Sears are typical of Keeler MKL's. The basic design provides true economy and efficiency with quick response to load changes. MKL's are cross drum, bottom supported type available in capacities up to 70,000 lb stm/hr. They're easy to maintain, flexible to space requirements, efficient and durable.

There's a dependable Keeler Water Tube Steam Generator for every requirement . . . from low cost package units to 100,000 lb/hr and field erected units up to 200,000 lb/hr—for all fuels, all types of firing. *Write or phone for complete information . . .*

**KEELER MKL**



*WRITE FOR FREE BULLETINS . . .*
No. MKL-1: Type MKL Boilers
No. MK-1: Type MK Boilers
No. DK-2: Type DK Package Boilers
No. F-14: Type CP Boilers
No. M-2A: Type CPM Package Boilers

**KEELER WATER TUBE Boilers**

*The Seal of Quality in Water Tube Steam Generators*

— ESTABLISHED 1864 —

**E. KEELER COMPANY**
400-500 West Street
Williamsport, Penna.

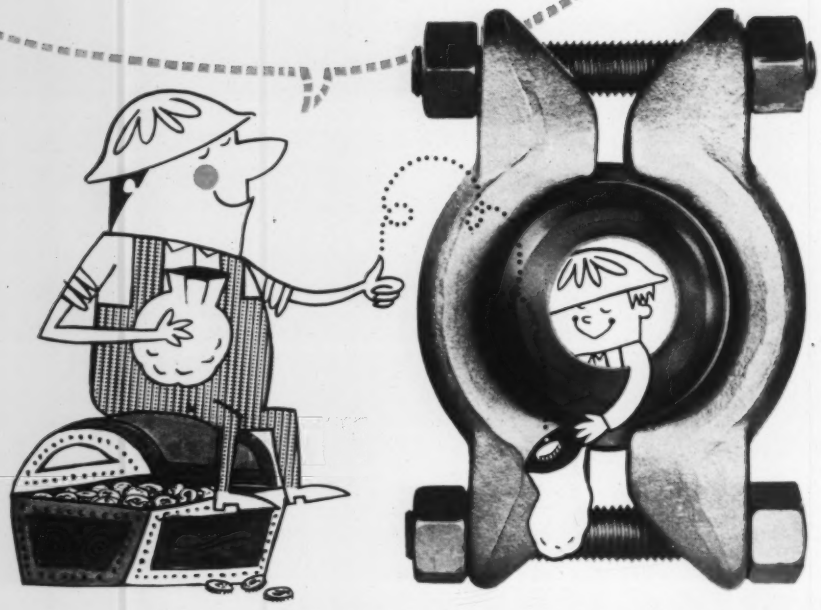
— OFFICES IN PRINCIPAL CITIES —
In Canada: Canadian Vickers, Ltd., Montreal

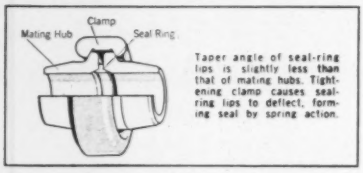
**SEARS**
**ROEBUCK AND CO.**
**Mail Order Plant**
**Philadelphia**

The plant serves catalog customers in 8 states and the District of Columbia. Also located here are Sears' eastern territory headquarters offices, a department store, rail and motor freight terminals and warehouses.

Circle No. 78 on Readers' Service Card

# How Grayloc® Pipe Connections Can Save You Money




Clamp
Mating Hub
Seal Ring
Taper angle of seal-ring lips is slightly less than that of mating hubs. Tightening clamp causes seal-ring lips to deflect, forming seal by spring action.

Money isn't always measured in dollars — around a shop or plant it may be disguised as space, time, effort, weight, trouble and inventory. With GRAYLOC Pipe Connections, you're saving in all these categories.

Specifically, GRAYLOC Connections are smaller than equally rated flanges so they weigh less. With only two bolts per connection, they take less time, trouble and effort to assemble.

The completely re-usable, all metal seal ring eliminates the need for replacement gaskets, so you save again on inventory and on maintenance time. Fluctuating temperatures and pressures, external stress or vibration never lead to loose, leaky GRAYLOC Connections. After they're assembled, they never need re-tightening.

GRAYLOC Connections are manufactured in standard stock sizes from 1″ to 30″, with special sizes available on request. They can easily be made of corrosion resistant metals on short notice. To learn the complete, validated GRAYLOC story, write today for the GRAYLOC catalog.

GRAYLOC SALES DIVISION

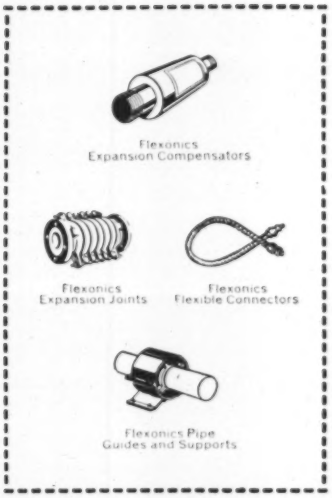
GRAY Tool Company

P. O. BOX 2291 • HOUSTON 1, TEXAS • RIverside 7-1240

Circle No. 64 on Readers' Service Card

6113

# the only complete line to handle every pipe movement problem!




Wherever there's pipe movement . . . thermal growth . . . vibration . . . there's a Flexonics product to absorb, guide, or control it.

**Flexonics Corrugated Expansion Joints** are expertly engineered to your needs, hydraulically formed, metallurgically treated by exclusive techniques, for maximum cyclic life. **Flexonics Expansion Compensators** offer the lowest-cost way, inch for inch, to absorb thermal growth in pipes or tubing 3" and smaller. **Flexonics Flexible Connectors** absorb vibration, permit random movement in pipes up to 24". **Flexonics Pipe Alignment Guides** and Roller Pipe Supports provide better guiding than old-fashioned methods, yet they cost less. **Check and mail the coupon today.**

**Flexonics**

DIVISION OF CALUMET & HECLA, INC.
348 East Devon Avenue • Bartlett, Illinois

FLEXIBLE METAL and SYNTHETIC HOSE
EXPANSION JOINTS
BELLOWS • SPECIAL TUBULAR ASSEMBLIES

In CANADA
FLEXONICS CORPORATION OF CANADA, LTD.
BRAMPTON, ONTARIO

ATTACH TO YOUR LETTERHEAD—MAIL TODAY!

Flexonics
348 E. Devon Ave.
Bartlett, Ill.

Please rush me complete information on

- ☐ Expansion Joints
- ☐ Expansion Compensators
- ☐ Flexible Connectors
- ☐ Pipe Guides and Supports

Circle No. 55 on Readers' Service Card

*Engineering Data*

**WINSMITH SPEED REDUCERS**

# HOLLOW SHAFT WORM GEAR SPEED REDUCERS

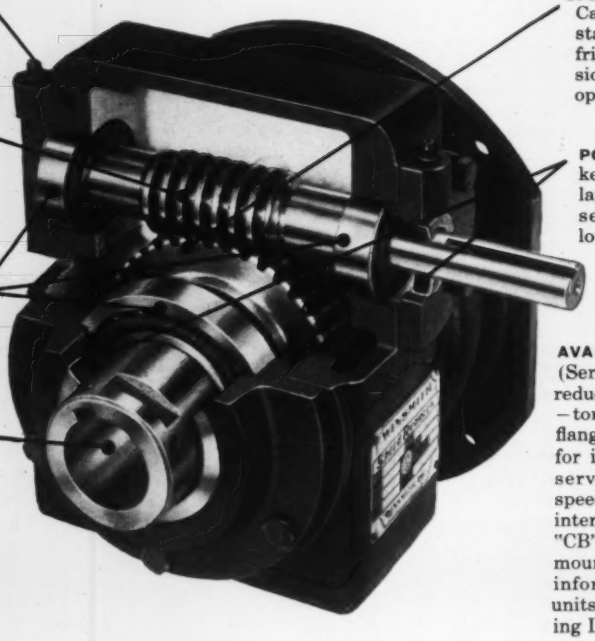
*single and double reduction . . . torque arm and flange mounted models*

**CAST IRON HOUSINGS** designed for high heat radiation. One-piece construction, close-grained gray iron for maximum strength and rigidity.

**CASE-HARDENED STEEL WORMS** cut integral with the shaft. Heat treated for close-grained tough core, carburized and hardened before grinding. Meet AGMA long-wear specifications.

**TAPERED ROLLER BEARINGS** for minimum maintenance, long bearing life and permanent shaft alignment. High radial and thrust load capacity.

**HOLLOW SLOW SPEED SHAFTS** in wide range of standard bore sizes and keyways. Mounts on shaft of driven machine *without bushings*—two external slots facilitate removal with standard wheel puller.



**SPECIAL BRONZE WORM GEARS** Cast to recommended AGMA standards. Low coefficients of friction and thermal expansion for cooler, more efficient operation.

**POSITIVE OIL SEALS** keep oil in, dirt out. Shafts lapped to micro-finish under seals for uniform contact, longer seal life.

**AVAILABLE** in single reduction (Series ST and SF) and double reduction (Series STD and SFD)—torque arm ("T" models) and flange mounted ("F" models)—for intermittent or continuous service. Hollow shaft slow speed assembly of "ST" series interchangeable with Winsmith "CB" and "CT" Series with foot mounted housings. For further information on these latter units, write Winsmith Engineering Department.

- *12 Models*
- *.041 to 8.82 H.P.*
- *Ratios 7½:1 to 4466:1*
- *Max. Output Torque 816 to 7678 in. lbs.*

Winsmith Hollow Shaft Speed Reducers cover a broad range of power transmission requirements for both single and double reduction drives. *Their worm gearing provides much higher reduction ratios than are possible in comparable size units using other types of gearing.* Winsmith Hollow Shaft models are designed for all applications where it is advantageous to mount the reducer on the shaft of the driven machine. They are compact, easy to install and require less space than conventional units. Their design and construction provide high shock load resistance; maximum thermal capacity without induced cooling; greater overhung capacity; and a high degree of standardization which eliminates excessive special application engineering.

Write today for complete information or call your nearest Winsmith Representative listed in the Yellow Pages. He is a technically trained expert who is always ready to help you with any speed reducer problem. For both standard and special power transmission applications, you'll find it pays to standardize on Winsmith.

**WINSMITH, INC.**

**203 Eaton Street, Springville, (Erie County), New York**

MEMBER OF AGMA

• • • Winsmith Speed Reducers are made by American craftsmen to meet American design and production standards.

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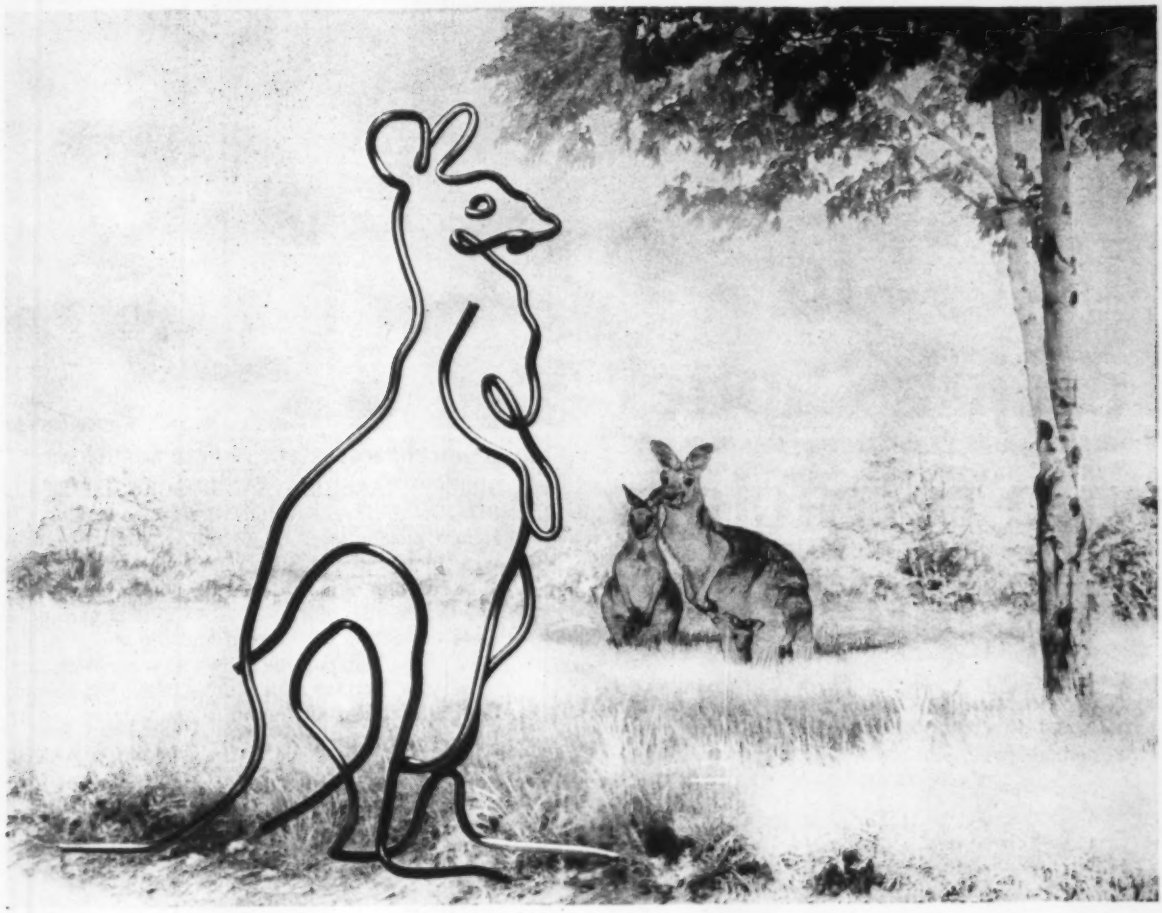
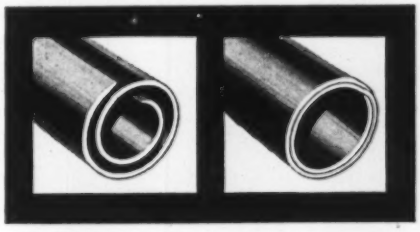


# Bundy can mass-fabricate practically anything

Almost any tubing problem can be solved by Bundy. Engineering and design specialists at Bundy are experienced in working out efficient fabrication methods and can often come up with design simplifications which reduce costs. Reason? Design and mass-fabrication of tubing components are our business . . . and have been for a long time. And you can make more different complex bends and shapes with Bundyweld® steel tubing. It meets Govt. Spec. MIL-T-3520, Type III; ASTM 254; and SAE specifications. Call, wire, or write: Bundy Tubing Company, Detroit 14, Michigan.



* * *

Bundyweld, double-walled from a single copper-plated steel strip, is metallurgically bonded through 360° of wall contact. It is lightweight, uniformly smooth and easily fabricated . . . has remarkably high bursting and fatigue strengths. Sizes up to 5/8" O.D.

## BUNDY® TUBING COMPANY

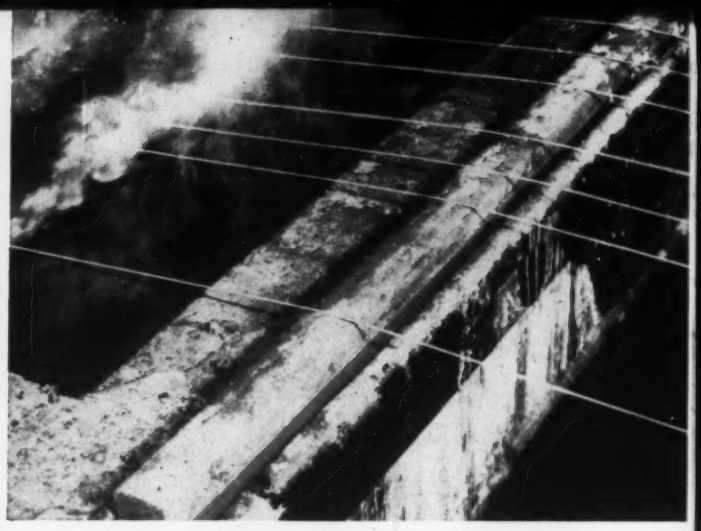
DETROIT 14, MICH. • WINCHESTER, KY. • HOMETOWN, PA.

WORLD'S LARGEST PRODUCER OF SMALL-DIAMETER TUBING. AFFILIATED PLANTS IN AUSTRALIA, BRAZIL, ENGLAND, FRANCE, GERMANY, ITALY, JAPAN.

Circle No. 29 on Readers' Service Card

*Report from Carborundum:*

# 6 ways to do jobs better with refractory materials



**HANDLING MATERIALS IN ACID SOLUTIONS:**

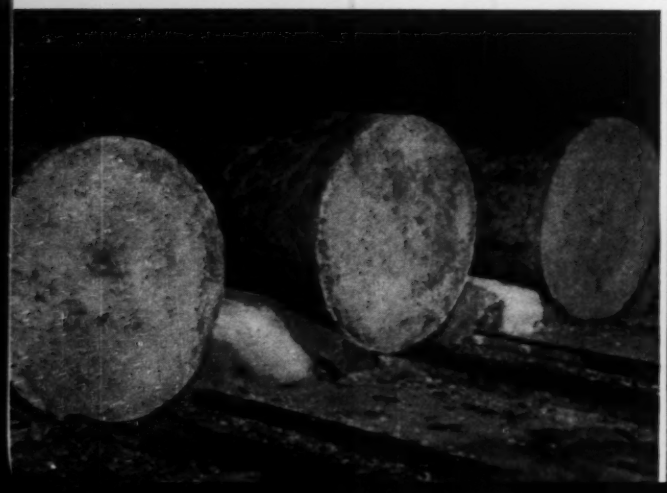
SILICON CARBIDE WEAR BLOCKS RESIST CORROSION AND ABRASION. Steel wire moving at 100 ft/min passes over CARBOFRAX® silicon carbide wear blocks to a pickling tank in the photo above. A 15% solution of sulfuric acid at 400 F is used. Sinker blocks are also of CARBOFRAX silicon carbide. Despite the action of the acid and the abrasion of the wire, the silicon carbide shows no wear after months of service. Similar applications involving Carborundum refractories are found in aluminizing and other wire coating baths.

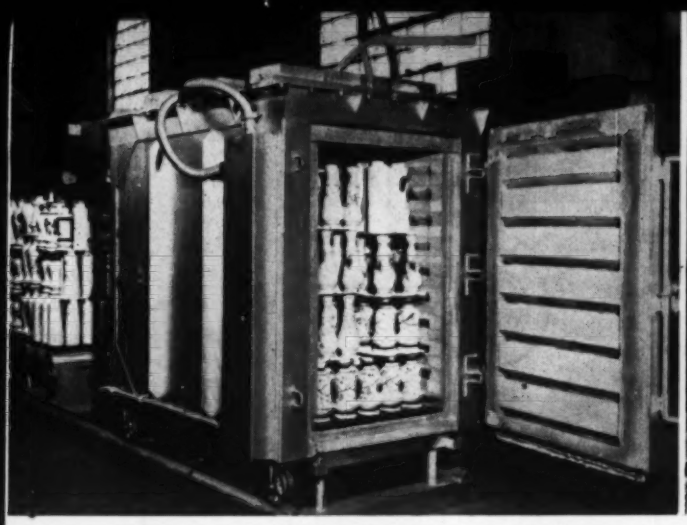
**SKID RAILS IN REHEAT FURNACE:**

SILICON CARBIDE RAILS LAST 30 TIMES AS LONG AS STEEL IN HIGH TEMPERATURE, ABRASIVE SERVICE. The 6¾" x 8" brass billets seen in the picture are pushed through a 38-foot long gas-fired extrusion mill furnace. Steel skid rails required replacement every five weeks. When CARBOFRAX silicon carbide rails were installed, 156 weeks of service were obtained. Reduction in downtime resulted in lower operating costs and higher production rates. Superior wear resistance and ability to withstand high temperatures make silicon carbide a profitable choice for applications like this.

**LONGER LIFE FOR BURNER RINGS:**

SILICON CARBIDE CONSTRUCTION WITHSTANDS FLAME EROSION AND HIGH TEMPERATURES. Refractory burner rings in pulverized coal-fired boiler frequently fail fast because of the abrasive action of the fuel particles and thermal shock due to intermittent operation. Many users have found an answer to the problem in CARBOFRAX silicon carbide rings. Silicon carbide is not only superhard, but also stays hard at high temperatures. High thermal conductivity and resistance to thermal shock minimizes cracking and spalling. Flame patterns are maintained.





**DIRT-FREE OPEN FIRING WITH MOVABLE KILN:**

FIBERFRAX® CERAMIC FIBER LINING REPLACES BRICK: MAKES POSSIBLE TEMPERATURES UP TO 2200 F. The interesting movable kiln illustrated is made by Unique Kiln Co., Hillsdale, N. J. It moves on rails to enclose a stationary loading bed. Two beds can be serviced alternately. Door and hood linings of Carborundum's light-weight FIBERFRAX ceramic fiber, in block form, eliminate the problem of dislodged dirt and dust encountered with fireclay type refractories, which often damage ware being fired. High heat resistance and insulating properties of FIBERFRAX fiber make possible firing up to 2200 F.

**SHAPES AND JIGS MACHINED FROM CERAMIC:**

BORON NITRIDE IS EASILY MACHINED; RESISTS HIGH TEMPERATURES AND CORROSION. The photo shows the machining of a semi-conductor jig from Boron Nitride, a self-bonded material made by Carborundum. Close tolerances, high surface finish and intricate detail are possible. Boron Nitride offers advantages in semi-conductor production compared with graphite jigs, yields from which often drop 40% after only 50 cycles. The material also offers possibilities for insulating tubes and shapes; chemical equipment parts, crucibles, brazing fixtures, gaskets and seals. Shapes withstand furnace temperature of 3000 F; powder as high as 5400 F.

**ELIMINATING CRACKING IN KILN CAR TOPS:**

COMBINATION OF REFRACTORIES SOLVES PROBLEM IN CERAMIC INDUSTRY. Used in a gas-fired electrical porcelain kiln, the cars illustrated have been in service for more than two years at cycles of 14 to 15 hours, operating from cold to 2290 F to cold. Car top cracking due to heat shock has been eliminated by use of three different Carborundum refractories—a bottom layer of MULLFRAX® electric furnace mullite for high load carrying capacity, a middle course of ALFRAX® alumina "bubble" brick for insulation and an upper course of CARBOFRAX silicon carbide tile for resistance to thermal shock.

## Want help on your problems?

Carborundum engineers will be glad to recommend refractories to answer your specific needs. For information, contact Dept. ME-81, Refractories Division, Carborundum Co., Perth Amboy, N. J. Descriptive brochures available on request. Please specify the area or areas of particular interest to you.

*for engineered refractories...count on*

**CARBORUNDUM®**

Circle No. 31 on Readers' Service Card

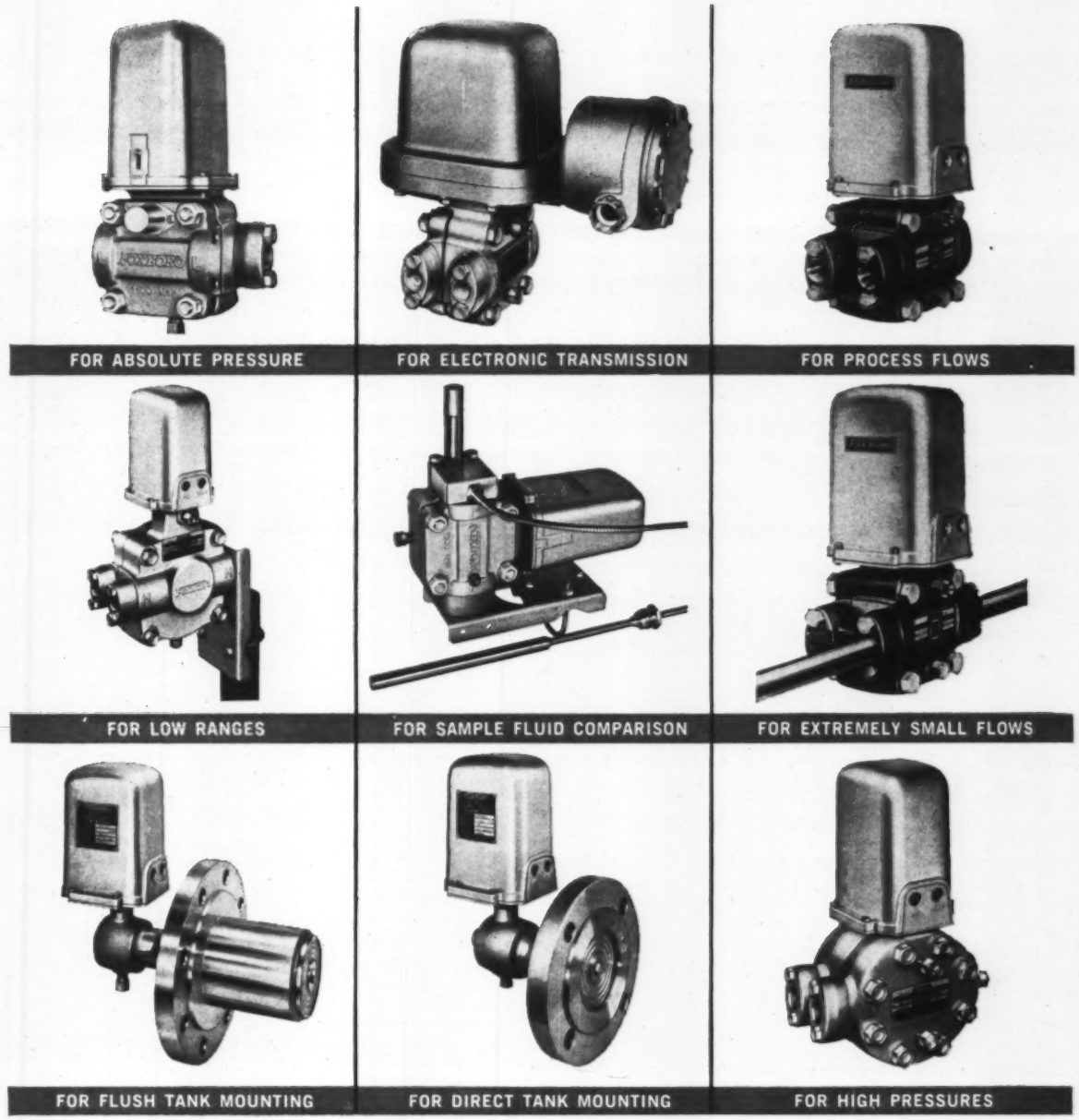
**AT THE HEART OF THINGS**

This 20th anniversary of the U. S. Savings Bonds program is an important milestone for the 45,000 companies, large and small, which offer the Payroll Savings Plan to their employees. Payroll Savings is the heart of the bond program, and the means by which millions of families have seen dreams realized since 1941. It has been good for business and industry... good for local communities... good for the nation's economic welfare. Above all it is good for the citizen who sees in each Savings Bond a share in his country's future.

If yours is one of the 45,000 participating companies, this anniversary year offers a good reason for renewed promotion. For help and suggestions, contact your State Savings Bonds Director, or write: **U.S. Savings Bonds Division, Treasury Department, Washington 25, D.C.**

**U.S. SAVINGS BONDS DIVISION—**
**20 YEARS OF SERVICE TO AMERICA**

The U. S. Government does not pay for this advertisement. The Treasury Department thanks, for their patriotism, The Advertising Council and the donor above.




# these Foxboro d/p Cell* Transmitters are related ...in design – in accuracy – in savings for you

Nine different process applications — all using the same basic Foxboro d/p Cell.

Consider the advantages of this standardization for your plant. Universal calibration techniques — simplified training of personnel — reduced stocks of component parts. Plus the highest sustained accuracy of measurement and transmission under the most punishing operating conditions.

Pneumatic or electronic, why not standardize on industry's standard — the Foxboro d/p Cell Transmitter. Write today for descriptive literature. The Foxboro Company, 968 Neponset Avenue, Foxboro, Massachusetts.

*Reg. U. S. Pat. Off.*

FOXBORO

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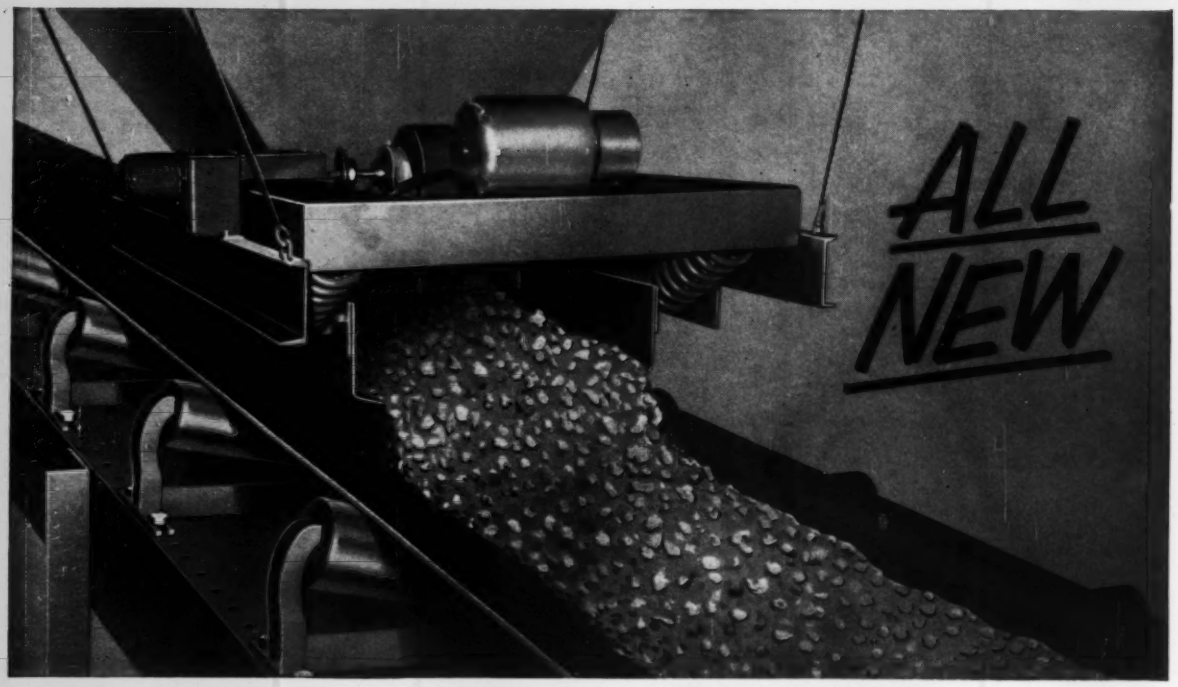
# STEPHENS-ADAMSON




# Revolutionary "SOLID STROKE" variable rate Vibrating Feeder!

- **POSITIVE STROKE** — The only vibrating feeder offering a solid drive connection to insure full amplitude of any stroke setting. No dampening under varying headloads.
- **AUTOMATIC STROKE CONTROL** — Offers variable conveying speed from 0 to 90 F.P.M. Easily increase or decrease tonnage handled.
- **EFFICIENT POWER FACTOR** — Standard AC electric motors, operating at peak efficiencies result in high power factor and reduced operating costs.
- **VARIABLE FEED RANGE** — The revolutionary new variable eccentric drive provides variable rate feed, first of its kind ever offered. Manual or electrical remote controls available.
- **ANGLE OF FEED** — Breaking the barrier of solid drives and variable eccentrics, the high amplitude stroke now allows for feeding in a wide range of slopes, even up hill.
- **NATURAL FREQUENCY** — The only vibrating feeder taking full advantage of the well known principle of natural frequency over its full operating range.
- **BALANCED VIBRATION** — Patented balanced design makes use of reclaimed energies of the balanced weight, energies of a vibrating feeder never before available to do useful work.
- **LOW STRESS DESIGN** — Large, heavy duty, low stress coil springs distributed along the full length of the feeder storing and releasing energy, decentralizes stress points resulting in a minimum of fatigue and bending stress.
- **HIGH CAPACITY** — Solid drive connection insures large amplitude strokes eliminating dampening and providing 50 to 100% greater capacities per given size feeder than has heretofore been attained.

REQUEST BULLETIN 261

S-A
ENGINEERED BULK HANDLING SYSTEMS
MATERIALS HANDLING PRODUCTS
SPEEDWALK® PASSENGER CONVEYORS
SPHERCO® BEARINGS & ROD ENDS

**ENGINEERING DIVISION**

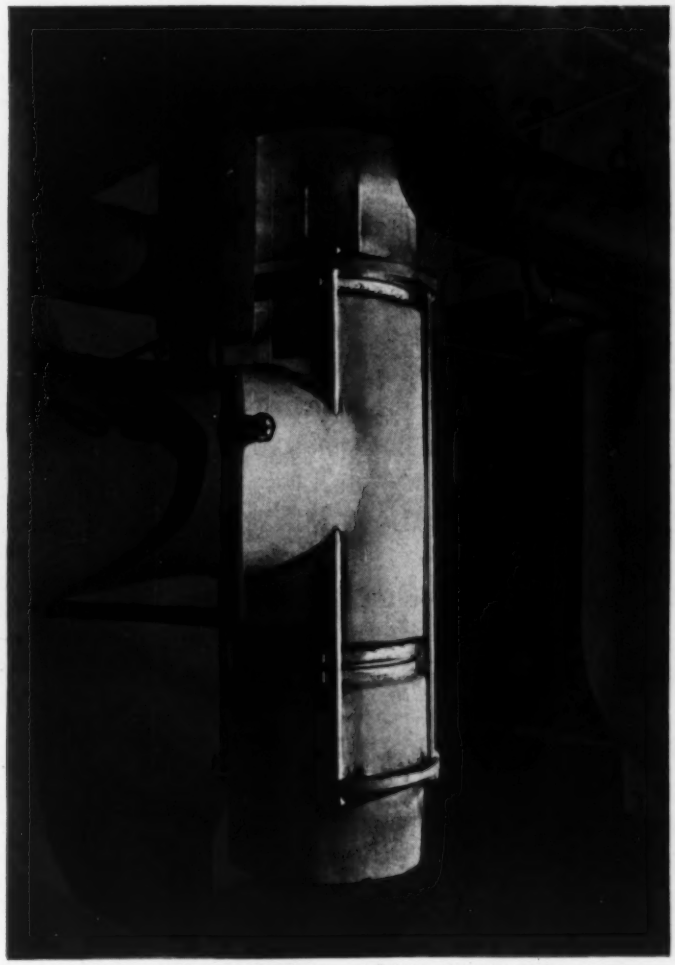
**STEPHENS-ADAMSON MFG. CO.**

GENERAL OFFICE & MAIN PLANT, 19 RIDGEWAY AVE., AURORA, ILL.

PLANTS LOCATED IN: LOS ANGELES, CALIF. • CLARKSDALE, MISS.
BELLEVILLE, ONT. • MEXICO CITY, D. F.

Circle No. 119 on Readers' Service Card

In the foreground, a 20" ZALLEA Universal Expansion Joint absorbing lateral movement.



At a major Eastern oil refinery, a 20" Zallea Pressure Balanced Expansion Joint installed on a steam turbine exhaust nozzle.

# it's ZALLEA for maximum reliability... the tough jobs show why

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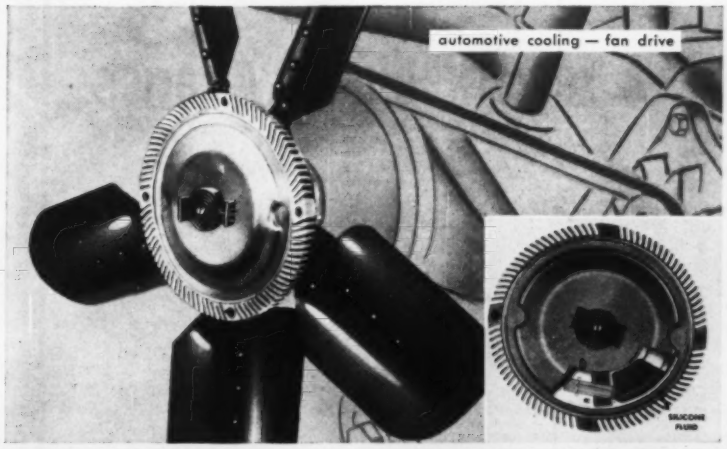


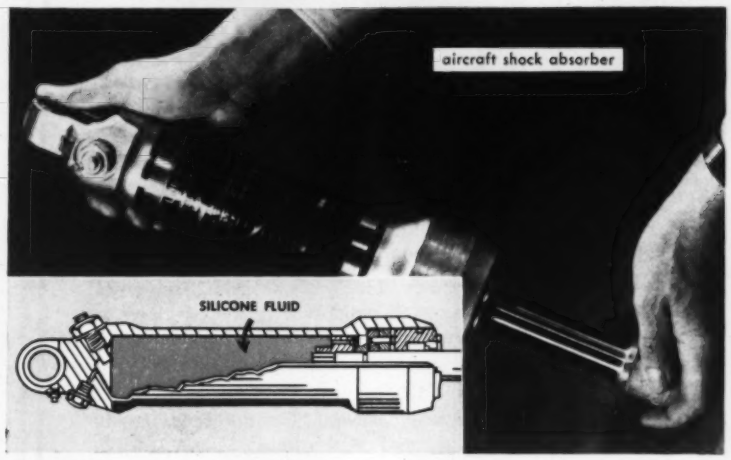


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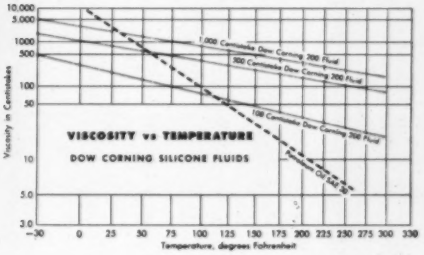


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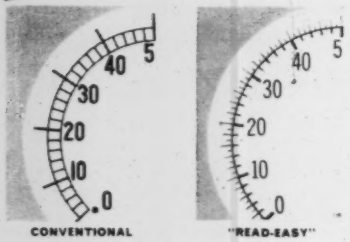
Get all the facts about this remarkable new example of Marsh quality and value.

*Ask For New Bulletin*

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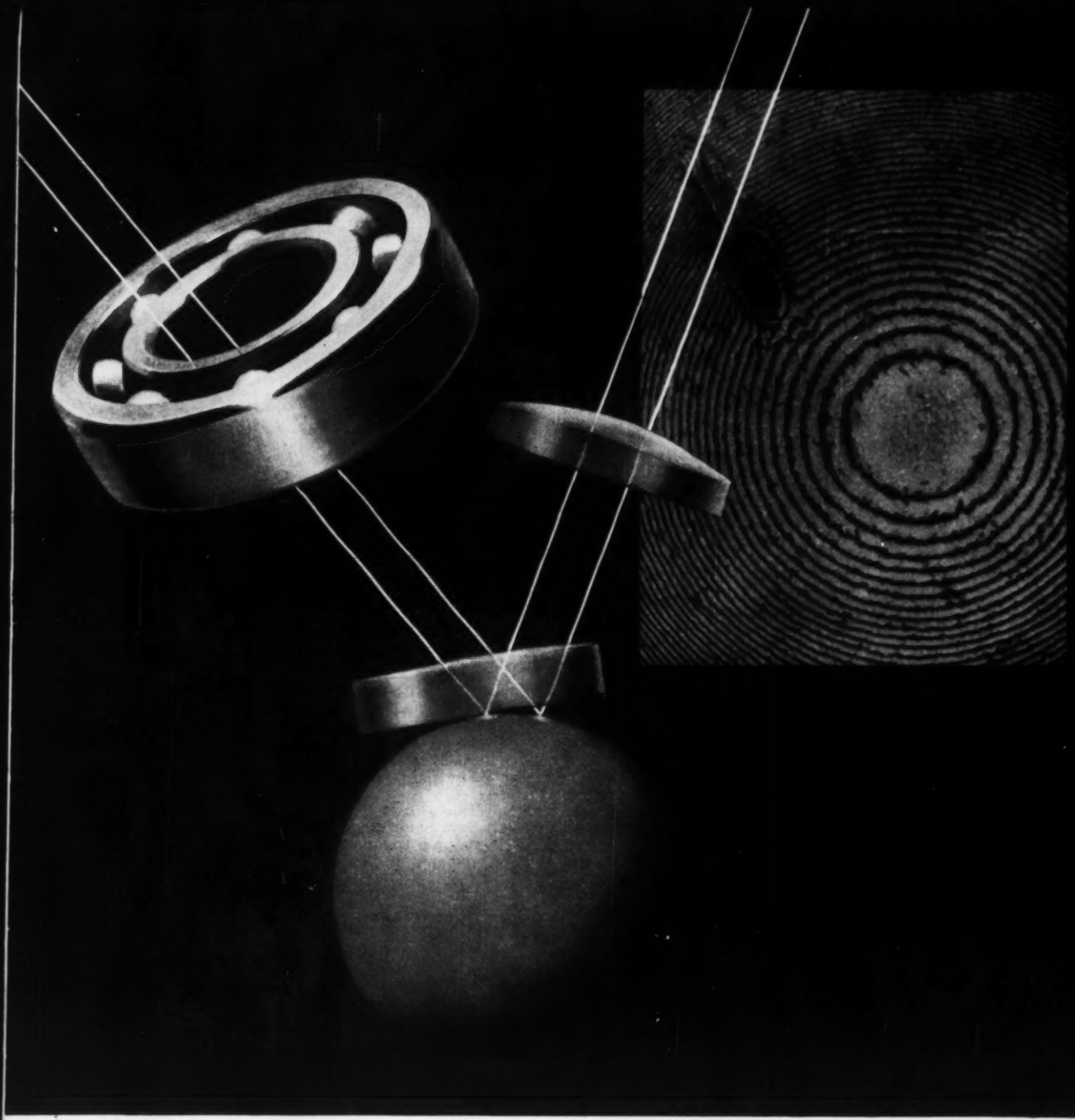

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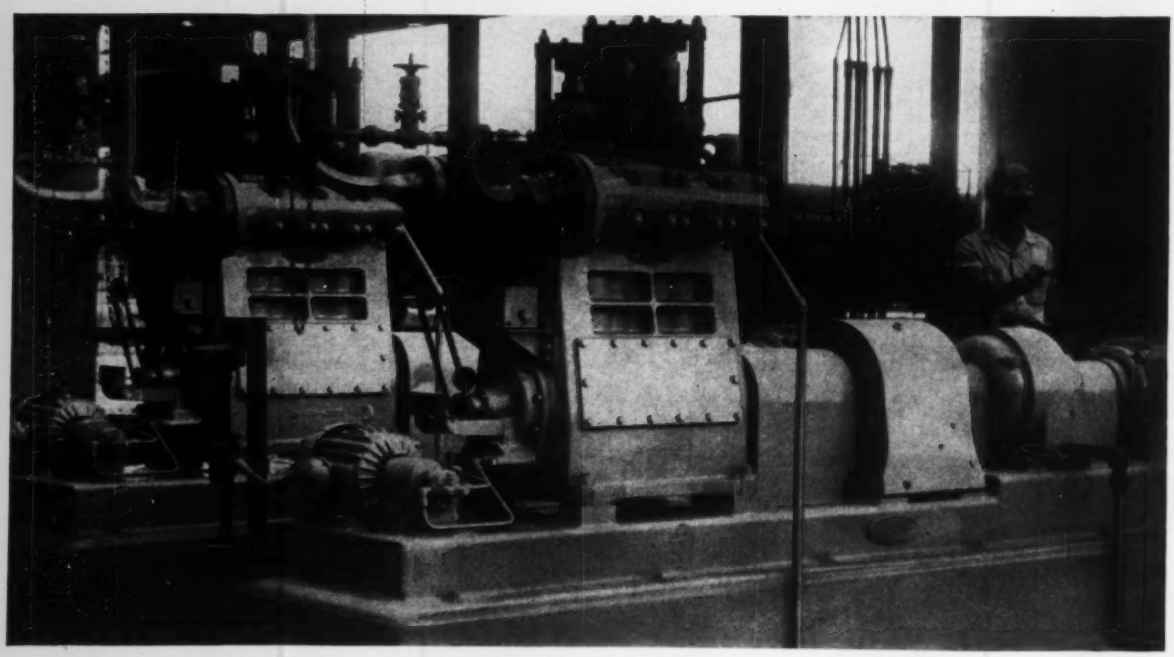

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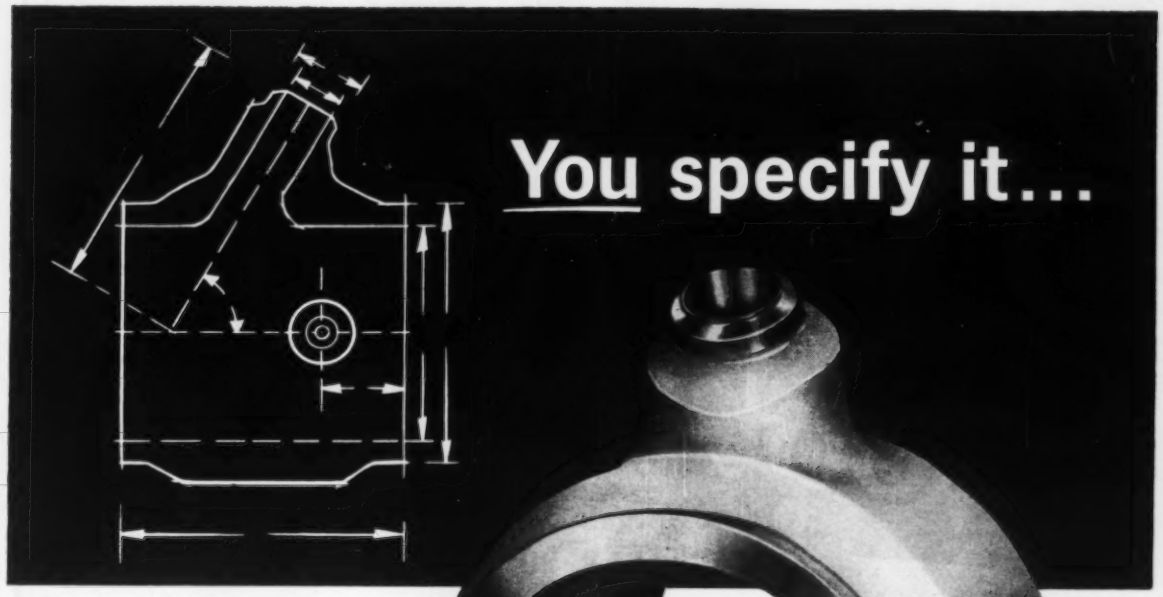


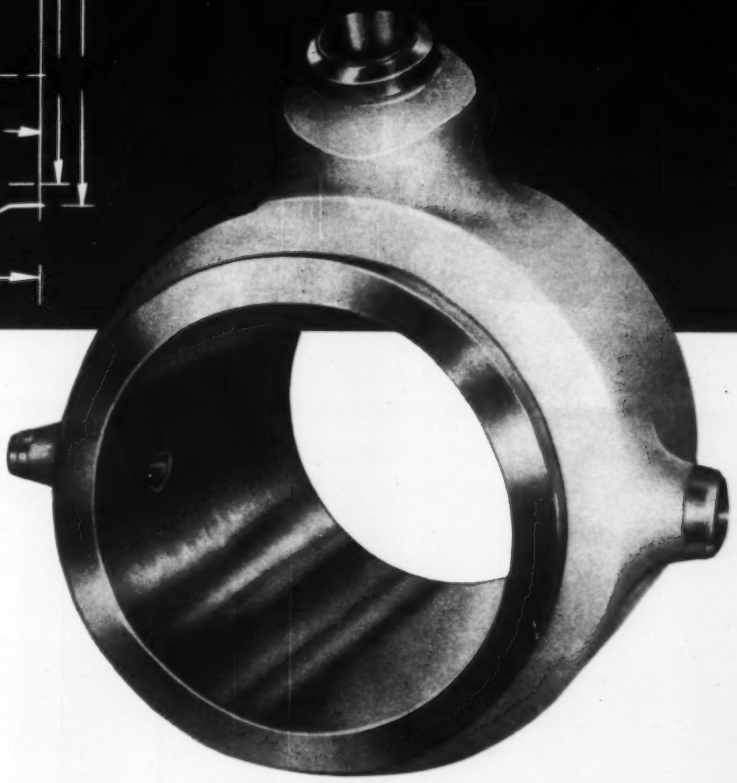

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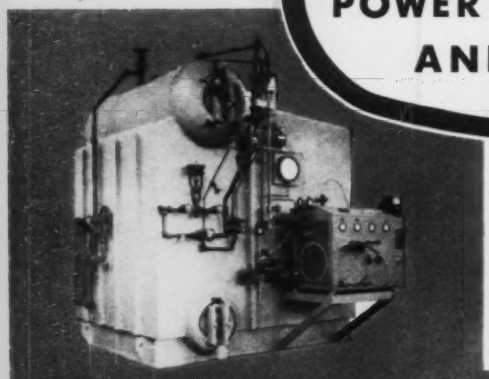

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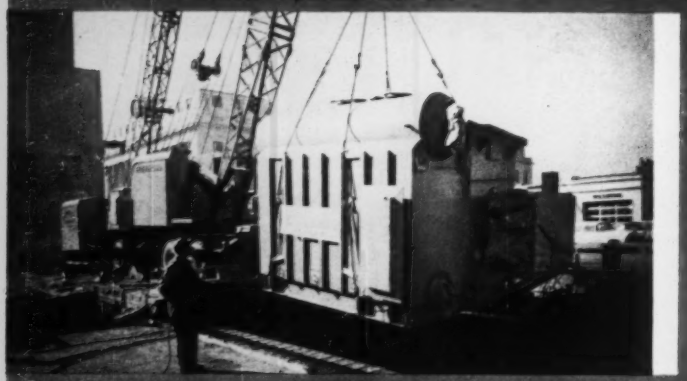

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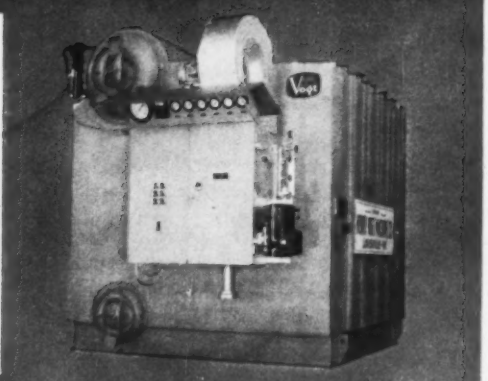

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# MECHANICAL ENGINEERING

VOLUME 83 • NUMBER 8 • AUGUST 1961


## We Grow Bigger - and We Decentralize

WHAT is ASME doing to improve its services to members? And how is the Society moving to meet the growing needs of mechanical engineers? In President Byrne's article, pages 38–39, he places before you a number of proposals for possible improvement in the ASME operation. Meanwhile, certain changes, long under consideration, are going into effect.

Four newly formed Department Executive Committees of the Professional Divisions recently held their organization meetings. Purpose of the four Departments is to replace the Professional Divisions Executive and Planning Committees, thereby providing a more effective medium for decentralization.

This sweeping change in the ASME organizational structure harks back to April 10, 1958, when the Board on Technology appointed a special Technical Interests Committee to develop a better method of fulfilling member needs.

After numerous discussions with other ASME groups and members of Staff, a workable plan was adopted by Council on June 11, 1961.

Basically, the plan calls for (1) Four Technical Departments (Basic Engineering, Industry, General Engineering, and Power) to supervise the Professional Division activities of ASME; (2) a Meetings Committee reporting to the Board on Technology and responsible for the planning of technical programs for the general meetings of the Society; and (3) a Publications Committee reporting to the Board on Technology, and responsible for establishing basic publication policy and making operating decisions.

The Basic Engineering Department will be composed of the Applied Mechanics, Automatic Controls, Heat Transfer, Hydraulic, Lubrication, and Metals Engineering Divisions. The Industry Department will consist of the Aviation, Petroleum, Process Industries, Railroad, Rubber and Plastics, Textile Engineering, and Wood Industries Divisions. The General Engineering Department will be made up of the Machine Design, Maintenance and Plant Engineering, Management, Materials Handling, Production Engineering, and Safety Divisions, and the Human Factors and Underwater Technology Groups. The Power Department will include the Fuels, Gas Turbine Power, Nuclear Engineering, Oil and Gas Power, and Power Divisions, plus the Air Pollution Controls and Solar Energy Applications Committees.

In addition to an Executive Committee, each Department will have an advisory member on both the Publications and Meetings Committees.

Complete details of the new plan will be found in "The ASME News."

Although various methods for departmentalizing technical activities had been considered in the past, the farsightedness of the Publications Committee in regrouping the Transactions of the ASME into a series of quarterlies has provided a sound basis for departmentalization.

Grouping of Divisions into these Departments will simplify the organizational structure. Major administrative responsibility for the functioning of each Professional Division is now delegated to its Department Executive Committee, thereby streamlining decision-making.

The new plan should also permit a more effective discharge of responsibilities at the working levels. Result: Considerable improvement in the Society's efforts to serve the technical interests of its members.

Besides improving the operating efficiency of the various units of the Society, these changes should result in expanded services, allow for greater operating flexibility, and provide an increased outlet for individual participation and initiative.—*J. J. Jaklitsch, Jr.*


**Editor, J. J. JAKLITSCH, JR.**

Perhaps it has seemed that ASME could do more for you—in the technical or the professional aspects of your work. Your Society is welcoming suggestions. Here, the President reports on ideas proposed and now under consideration.

# ASME: A

**By William H. Byrne,**[1]
President, The American Society of Mechanical Engineers

The American Society of Mechanical Engineers is presently engaged in a reappraisal of its activities, organization, and services to the membership.

Under the sponsorship of our Past-President, Walker L. Cisler, and with my hearty endorsement, your Council engaged the New York consulting management firm of Cresap, McCormick and Paget to take an impartial, critical look at our Society to find out what makes us tick—and when we don't tick, why we don't.

It was expected the report would collate facts that might explain why less than 40 per cent of our members contributed to the new headquarters building. Why, with an eight per cent gain in new members, we end up with a net gain of a little more than three per cent. Why there is apathy on the part of many mechanical engineers about joining a great society like our ASME, and why they prefer some of the so-called specialty societies. Why you find members who know so little about our Society and its activities, and why it takes so long to get some things done.

The report submitted by the consultants stated their objectives as follows:

To identify trends in membership of the ASME compared with certain other technical professional societies in the same general field and with the available market of engineers.

To identify the effect of ASME objectives, policies, organization, and services upon membership growth.

To interpret available data including the opinions of members as these relate to the over-all success of the Society.

Information used by the consultants for their study was drawn from their review of the Constitution, By-Laws, and Rules of the ASME; minutes of Council, Standing Committees, and Regional Administrative Committees; and our manuals and publications. They also analyzed membership data and compared them with those of the other founder societies and ten additional professional and technical societies. Their study included a review of the financial reports of our Society, studies of trends in engineering education, particularly enrollments and the tendency toward more generalized engineering courses and its effect on our membership.

Interviews by representatives of Cresap, McCormick and Paget were conducted with more than twenty members of the 1960 and 1961 Council, approximately ten additional senior members of the Society, five former members whose career achievements have been outstanding, and five faculty advisers to Student Sections.

In addition to these interviews, questionnaires were sent out to more than 2500 Associate Members and Student Members (since it is these grades of members that we are most anxious to reach), former members, and faculty advisers. Thirteen hundred of these questionnaires were returned and analyzed. This high rate of return shows the interest of the membership—52 per cent return of questionnaires is unusually high in this type of work. They also interviewed the Secretary, Assistant Secretaries, the Editor, and ten additional members of the headquarters staff. They attended the 1960 Annual Meeting, including a portion of the Council meeting and several other functions.

It should be noted that an element in the investigation was the contacting of former members who had dropped out. This is important: We wanted to hear from the group that found our services inadequate for their needs. But account should be taken of the fact many of these were behind the times. For example, within four years Mechanical Engineering changed its entire format, a change described by an editor of another publication as the most sweeping he had ever seen in such a magazine. Perhaps many of the dropouts never saw the new Mechanical Engineering, or the new *Transactions* group of magazines, or certain other changes in the Society's services to its members.

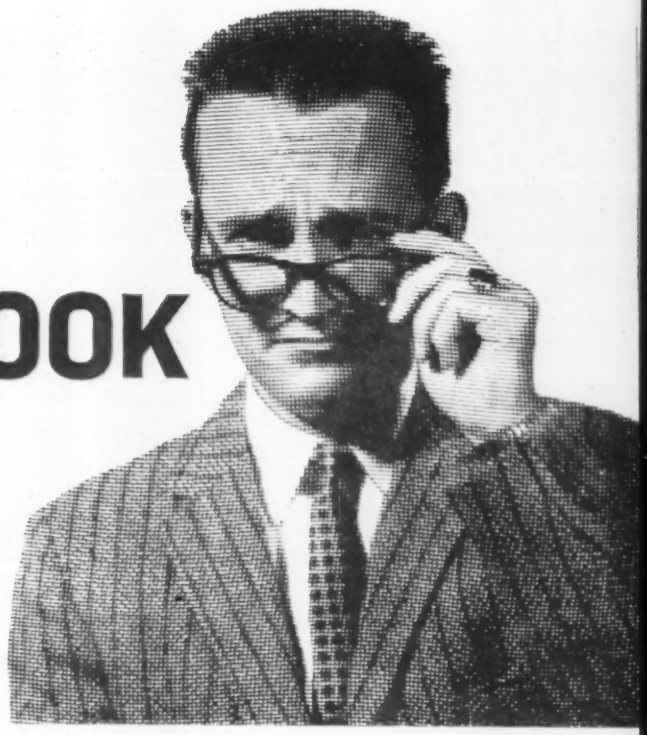
### Proposals to Be Considered

Now here is what the consultants propose. My stating these proposals does not mean acceptance by me or the Council. Our committees assigned to each of these areas will probably have ideas and recommendations of

[1] President, Byrne Associates, Inc., and Stevens & Wood, Inc., New York, N. Y.

Condensed from a speech delivered at the President's Luncheon at the Summer Annual Meeting, Los Angeles, Calif., June 11–14, 1961, of The American Society of Mechanical Engineers.

# CRITICAL LOOK



their own to submit for future Council consideration.

1 The Society should clarify its objectives in view of the changing aspects of the engineering field.

2 The Society should increase its efforts in the area of public relations, including internal communications, and revitalize its contact with the Sections.

3 The publications program should be strengthened. In this area they had several suggestions, such as establishing separate editors for *ASME Transactions* and MECHANICAL ENGINEERING. Other suggestions: MECHANICAL ENGINEERING should be improved in editorial content and typography; student members should be provided with a regular publication directed to their interests, either within MECHANICAL ENGINEERING or as a separate publication; paid commercial advertising should be accepted in the *ASME Transactions*.

4 Certain organization revisions should be made. Suggestions: The position of Secretary should be retitled Executive Secretary; activities of principal committees should be streamlined, and younger members should be introduced to committee work; volunteer committees should receive a higher quality of completed staff work in preparation for their meetings; consideration should be given to making the position of President less an honorary one.

(I recognize that being President is a great honor, but the work load has been such that, though I started off as the biggest[2] President the ASME has had, I may yet end up the skinniest despite the excellent support I receive from the staff and from my own organization. It begins to look as if the future trend might be toward a President who could give his full time to Society activities.)

Further organization suggestions: A development office should be established; the position of Assistant Secretary for Publications should be established; responsibility for commercial advertising should be consolidated; an understudy should be assigned for the publications business manager; personnel administration at headquarters should be strengthened.

5 The Society should develop a stronger tie with its membership.

6 The Society should establish policies for standardized financial control of each of its principal activities, review performance of each activity quarterly, and take action to control performance within the established policies.

7 Reporting and analytical activities relating to technical meetings should be clarified.

**The Long Needle**

Now, as to my opinion: I do not completely agree with all the conclusions of this report, nor do I feel they have proved all their points, but I believe it is a report of tremendous significance to us if we use it as a tool to improve the current operations of our Society. Good progress is being made, and I can assure you the long needle is out. But until those assigned to the study have submitted their conclusions, I suggest that no one prejudge these recommendations.

Maybe we are so busy trying to find fault with ourselves and confirming the ideas of the gripers that we are losing professional esprit de corps. In some 80 years of its existence, the Society has done a tremendous job for the engineering profession and for mechanical engineers as individual professional men. I think we have the finest Society in the world.

**THE PRESIDENT'S BASKET**

**We always want to hear from members, and this is a particularly opportune time for you to write us and present your ideas. Write to "The President's Basket," William H. Byrne, President, ASME, 29 West 39 Street, New York 18, N. Y. Let us know what's wrong . . . and what's good.**

[2] ED. NOTE: He weighs 260, or did when his term began.

# MEASURING MILLIONTHS

## . . . is one of the many jobs of the National Bureau of Standards.

THE pressing need to control the tolerances of many important and critical elements such as fuel injectors, bearings, gyroscopes, and transistors to tolerances expressed in hundred thousandths, or even millionths of an inch has caused machine-tool manufacturers to request that the National Bureau of Standards develop procedures for calibrating their master gage blocks to an accuracy of 1 part in 10 million.

### Progress in Measuring Techniques

During 1960, according to "Research Highlights of the National Bureau of Standards," in the NBS Annual Report, significant progress was made in the development both of highly stable gage blocks and of ultraprecise measuring techniques.

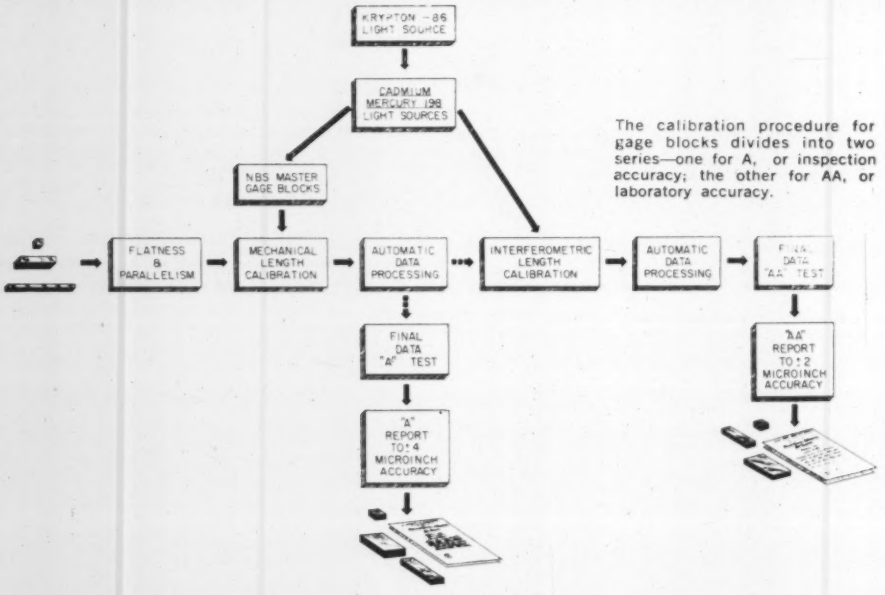
Three types of gage blocks, produced in the Bureau's metallurgy laboratories, showed dimensional stability considerably greater than that of the best commercial blocks. One type of gage block, nitrided for surface hardness, expanded only 0.0000002 in. per in. of its length in a year. Sixteen gage-block materials are now under investigation and have been given a total of 42 different metallurgical treatments

For the first time in its history, the NBS certified the accuracy of length measurements on two commercial gage blocks to better than 1 part in 5 million, and alloys which would permit regular calibrations to 1 part in 10 million are an object of NBS research. The measurements were made on a 16-in. and an 18-in. gage block by two independent methods, one of which gave the lengths in terms of wave lengths of light and the other directly in terms of the standard meter bar. The results agreed to the nearest millionth of an inch or better for both gage blocks. The NBS measurements also agreed within 2 millionths of an inch with independent measurements made by the National Physical Laboratory in England. Another gage block, 4 in. in length, was certified to one part in 4 million, and this result agreed with the measurements of two other national laboratories to 1 millionth of an inch.

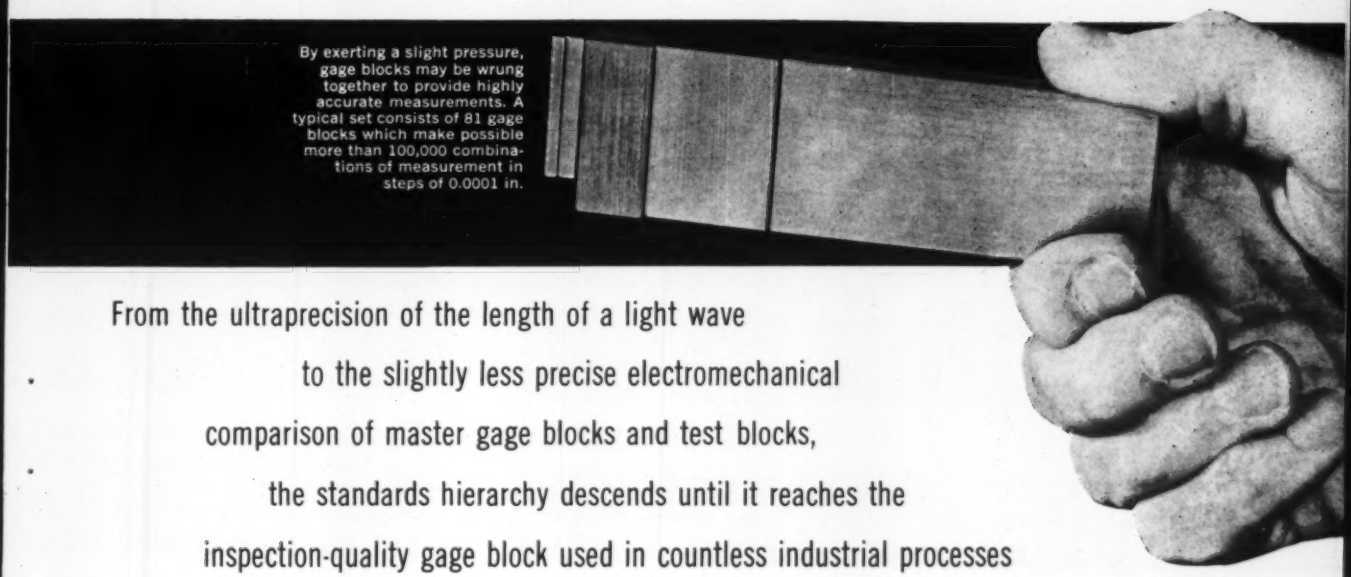
By calibrating from 5000 to 6000 gage blocks submitted to it each year, the NBS gage-block laboratory currently is providing industry with one of its most effective means of monitoring the increasingly close dimensional tolerances that are required. According to a recent NBS Summary Technical Report, calibrations with uncertainties as low as 1 part in a million are routinely available, permitting industry in turn to use the gage blocks for calibrating other equipment with only slightly less accuracy. Gage blocks of the highest attainable accuracy are also being applied directly in "custom" production work on critical projects.

In principle, it should be possible to provide calibrations of substantially higher accuracy as a result of: (*a*) The recent adoption of the krypton-86 wave length standard of length; and (*b*) improvements in use of auxiliary equipment, such as interferometers, needed in comparing wave lengths of light with the lengths of meter bars, gage blocks, or other solid objects. The main obstacle has been the dimensional instability of even the best alloys commercially available.

Adapted from a Summary Technical Report published by the Office of Technical Information of the National Bureau of Standards, U. S. Department of Commerce, Washington, D. C.


KRYPTON - 86 LIGHT SOURCE
CADMIUM MERCURY 198 LIGHT SOURCES
NBS MASTER GAGE BLOCKS
FLATNESS & PARALLELISM
MECHANICAL LENGTH CALIBRATION
AUTOMATIC DATA PROCESSING
INTERFEROMETRIC LENGTH CALIBRATION
AUTOMATIC DATA PROCESSING
FINAL DATA "AA" TEST
FINAL DATA "A" TEST
"A" REPORT TO ± 4 MICROINCH ACCURACY
"AA" REPORT TO ± 2 MICROINCH ACCURACY

The calibration procedure for gage blocks divides into two series—one for A, or inspection accuracy; the other for AA, or laboratory accuracy.



By exerting a slight pressure, gage blocks may be wrung together to provide highly accurate measurements. A typical set consists of 81 gage blocks which make possible more than 100,000 combinations of measurement in steps of 0.0001 in.

## From the ultraprecision of the length of a light wave to the slightly less precise electromechanical comparison of master gage blocks and test blocks, the standards hierarchy descends until it reaches the inspection-quality gage block used in countless industrial processes

### Gage Blocks and Their Use

In its simplest form, a gage block is a rectangular block of steel with square or oblong cross section and with two of its opposite faces—called gaging surfaces—ground and lapped flat and parallel to one another. The length of the block is defined as the perpendicular distance between the parallel faces; or, for highest precision, between one of the faces and a specified point on the other.

Extremely flat and highly finished gaging surfaces make possible: (*a*) Direct measurement in terms of wave lengths of light by interferometric methods; (*b*) the wringing together of two blocks by carefully sliding a gaging surface of one block over a gaging surface of another. When wrung together they offer considerable resistance to separation; and the thickness of the film between the blocks is normally well below 1 microin. (If it is necessary to combine large numbers of blocks, they may be supported in a gage holder. Some are made with a cylindrical hole in each perpendicular to the gaging surfaces, so that the blocks can be held together by a bolt passing through the hole.)

A typical set consists of 81 gage blocks, with sizes ranging from 0.05 to 4 in. Of the 81, there are 10 blocks with lengths from 0.1000 to 0.1009 in., in steps of 0.0001 in.; 50 blocks from 0.101 to 0.150 in., in steps of 0.001 in.; 17 blocks from 0.20 to 1.00 in., in steps of 0.05 in.; and single blocks with lengths of 0.05, 2, 3, and 4 in. With these 81 blocks, more than 100,000 combinations of measurements are possible in steps of 0.0001 in. By the additional use of 0.100025, 0.100050, and 0.100075-in. blocks, combinations may be made in steps of as little as 25 millionths of an inch.

Many industrial and scientific laboratories maintain one or more sets of master gage blocks which are used only to calibrate working sets. The latter are used for direct measurements or for calibrating various kinds of measuring instruments. Among many other applications, the blocks serve to test the accuracy of micrometer calipers, and of ring, plug, and snap gages; to check the lead of screw-thread gages; to calibrate strain gages, and mechanical or electronic indicating gages and comparators; and they are used with sine bars for precision angle measurements.

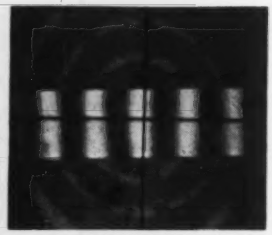
Precision gage blocks are classified into Grade AA or laboratory-quality blocks and Grade A or inspection-quality. Laboratory-quality blocks are manufactured to within a few microinches of their nominal length, that is, the length indicated on the block. As already mentioned, gage blocks exhibit a dimensional instability with the passage of time, as well as changes due to wear. Master blocks are seldom and very carefully handled and the change from wear is quite small, while the change caused by instability sometimes amounts to several microinches per year. Therefore, master blocks are recalibrated at intervals of from one to several years, depending on the type of usage and level of accuracy.

### Calibration Procedure

The first step in NBS calibration is to test the gaging surfaces for flatness and parallelism. Blocks with excessive deviations of either type are usually not calibrated; or, if they are, the accuracy of the measurements is not certified. In maximum-precision applications, it may be necessary to take into account even fairly small deviations, since lack of flatness of parallelism means that the length of the block will vary from point to point on the gaging surfaces.

The lengths of all blocks submitted for calibration are then determined by comparison with NBS master blocks of the same nominal size. These master blocks are calibrated against the laboratory's reference standards, light waves produced by cadmium and mercury 198. The lengths of these light waves are known very accurately in terms of the new international standard of length, the wave length of the orange-red spectral line emitted from atoms of krypton-86. Electromechanical comparators of the dual-transducer type show the difference

## MEASURING MILLIONTHS



**Above** To determine flatness of AA accuracy, interferometric patterns are obtained. The broad dark lines indicate a high degree of flatness. If the lines were curved, nonflatness.

**Left** Wringing gage blocks to a steel optical flat makes the upper surfaces of the flat and the blocks become mirrors in an optical system. The blocks can be measured by light waves when placed in an interferometer.

**Below** The measurements obtained with the electromechanical comparators used in calibrating gage blocks are recorded on punched cards for processing in a high-speed electronic computer which calculates the deviation of each block from its nominal length. At least two comparisons are made and if too much spread is noted, the block must be recalibrated.

**Calibration Services of The NBS Gage-Block Laboratory**

| Nominal value, in. | Accuracy of calibration, microin.* | Remarks |
|---|---|---|
| 0.010 to 0.090 | ±3 | Blocks in this size range are usually warped and do not warrant calibration to a higher accuracy. If errors in flatness are not excessive, it may be possible to calibrate blocks 0.040 in. and thicker to an accuracy of ± 2 microin. |
| 0.100 to 2.000 | ±2 or ± 4 | Two types of calibrations are available for gage blocks in these size ranges: Type AA, intended primarily for Grade AA (laboratory) quality blocks, is indicated by the first listed accuracy at left; Type A, intended primarily for Grade A (inspection) quality blocks, is indicated by the second listed accuracy. |
| 2 to 3 | ±3 or ± 5 | |
| 3 to 4 | ±4 or ± 6 | |
| 5 to 20 | ±1 per in. of length | Accuracy contingent on quality of gaging surfaces. |

* The accuracies listed are those routinely provided. Higher accuracies may be provided if the quality of the gage block permits.

in length between master block and test block. Each test block is compared at least twice with the master blocks. Tongs are used to handle the blocks so that variations from the 68-F temperature maintained in the laboratory will be held to a minimum.

Data from the electromechanical comparators are recorded on punched cards for processing in a high-speed electronic computer which calculates the deviation of each block from its nominal length. In arriving at an average value for the block, the computer examines both comparisons for excessive spread or variation between their values. When too much spread is noted, the block must be recalibrated.

If the set is being given an A calibration, the test is then complete and the final report is assembled. This report consists of a table showing the nominal size, identification, deviation from nominal length of each block, and any excessive deviations in flatness and parallelism. A text explaining the calibration is attached to the report.

### Special Procedures for AA Accuracies

When AA accuracies are required, interferometric measurements are made with light waves. Because the blocks are wrung to steel optical flats for measurements, the gaging surfaces must be completely free from burrs and substantially in "new-block" condition. After wringing, sufficient time is allowed for temperature equalization. The flats are then placed in the interferometer where the upper surfaces of the blocks and the flat become mirrors in the optical system.

Two interferometers, in which cadmium and the mercury isotope 198 are the light sources, are used to make two separate sets of measurements. The light from these sources consists of a number of monochromatic radiations (spectral lines), one of which is used from each source. Two determinations are made, using each source in turn. The blocks are then wrung to another optical flat, and this operation is repeated. Each of the spectral lines produces a pattern of optical interference fringes which serves, in effect, as a finely divided scale. One division on these scales corresponds to half a wave length of the light used (approximately 0.00001 in.), and it can be subdivided into tenths (approximately 0.000001 in.) without difficulty. During the measurements, precise determinations are made of air temperature, barometric pressure, and humidity, since these factors affect the wave length of light by changing the index of refraction of air. Temperature of the blocks is also measured and corrections are applied so that the final reported lengths are at the standard temperature of 68 F.

The additional data obtained from the interferometric measurements such as observed interference-fringe fractions, phase-shift corrections, coefficient of expansion, temperature, barometric pressure, and humidity are then fed into the computer which uses them to calculate the length of each block at 68 F. It is interesting to note that from computations such as these, the accuracy of the NBS master gage blocks is indirectly verified. This verification is accomplished by comparing the results of the mechanical comparisons with those of the interferometric comparisons.

The final report for an AA calibration is essentially the same as that computed for an A calibration except that more stringent requirements for flatness and parallelism are observed, and higher accuracies are obtained.

# PLASMA-TORCH CUTTING

**By James A. Browning,** Assoc. Mem. ASME
**and George A. Klasson**
Thermal Dynamics Corporation, Lebanon, N. H.

**How does the arc-plasma cutting process compare with oxy natural gas? Initial investment is greater, but operating economies are considerable. Now it is competitive for mild-steel processing.**

Cut surfaces obtained with plasma-torch cutting are of good quality. The top cut is $^1/_2$ in. thick with $^3/_4$, 1, $1^1/_2$, and 2 in., in that order. The cutting speed, shown in inches per min, decreases with the increase in thickness.

THE plasma torch is finding rapid acceptance in many industrial fields, particularly for the cutting of metals, where it offers great advantages over other techniques. For example, with $^1/_2$-in-thick mild-steel plate, where maximum oxygen-cutting speeds are under 25 ipm, the plasma torch produces high-quality cuts at 200 ipm at much-reduced cost.

Both monatomic gases (such as argon and helium) and diatomic gases (such as nitrogen and hydrogen) may be heated (usually electrically) to such extreme temperatures that the atoms are ionized. The resulting free electrons and positive ions produce an electrically neutral plasma. In addition to lower cost when the diatomic gases are used, the potential temperatures are higher, as indicated in Fig. 1.

In the case of the diatomic gas sensible heating occurs until a temperature approaching 5000 F is reached. Dissociation effects then predominate and large quantities of heat are required to raise the temperature a significant amount. For the case of the oxy-fuel flame the peak combustion temperature, point A, is limited by the available heats of reaction.

Peak gas temperatures are not limited by dissociation effects when the electric arc is substituted for a chemical reaction. As shown in Fig. 1, complete dissociation may be realized. Additional heating of these dissociated species leads to further sensible heating—in this case of individual atoms. Ionization effects become important for nitrogen at about 15,000 F.

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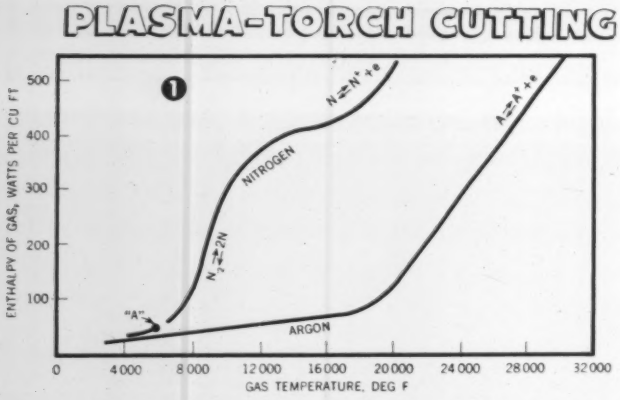



**Fig. 1** The heating of a monatomic gas (argon), compared with that of a diatomic gas (nitrogen). With the diatomic gas, sensible heating occurs until about 5000 F, when dissociation effects predominate and large quantities of heat are required to raise the temperature significantly. Point A is the peak combustion temperature for the oxy-fuel flame and is limited by the available heats of reaction.

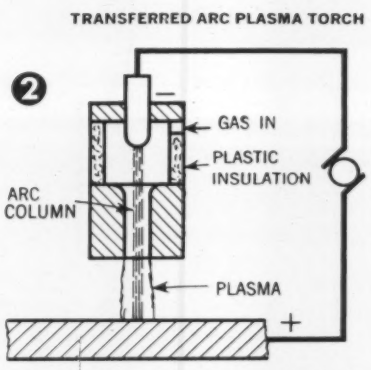



**Fig. 2** The two major categories of plasma generators are the transferred-arc plasma torch, in which the arc and plasma stream are projected beyond the torch device. In the nontransferred mode of operation,

Argon is raised by sensible heating to the ionization temperature. A comparison of the two curves in Fig. 1 illustrates the advantage of the more complex gases. Large quantities of heat are held in the gas at temperatures much below those which would be required by a monatomic gas. This fact is of particular importance.

The diatomic gases require a higher arc voltage. For a given electrical power level the amperage is significantly less than for the monatomic case. As electrode heating losses and erosion are primarily a function of the current flow, higher powers and electrical-to-gas heating efficiencies are realized. From a heat-transfer standpoint much higher rates of heating are possible using a plasma which reassociates upon cooling. This is particularly true for hydrogen which has commonly been used in conjunction with unconfined electric arcs for welding for many years.

Plasma-generating devices operate on the principle of confining the gas to remain within the electric-arc column for an appreciable period of time. In this context "appreciable" refers to that amount of time required for multiple collisions of the gas particles by the electrons. An unconfined arc produces maximum gas temperatures of about 20,000 F, whereas nearly unlimited temperatures are theoretically possible utilizing various confining principles.

Plasma generators may be divided into two major categories, Fig. 2. The first is the transferred-arc-plasma in which the arc and plasma stream are projected beyond the torch device. In the nontransferred mode of operation the arc circuit is completed within the torch, the plasma being projected through the nozzle.

The nontransferred plasma torch is used as a substitute for the oxy-fuel flame in such applications as metallizing, chemical synthesis, and even as a wind-tunnel gas heater. For maximum heat-transfer rates the transferred-arc-plasma is used. Here an exterior anode must be provided. In metal cutting this anode is the workpiece. Heating is by both anode and convective gas action.

### The Transferred-Arc Torch

The transferred-arc torch has been used on a limited basis during the past six years. Early designs were used mainly for the cutting of nonferrous and other metals not capable of being oxygen cut. Recently, the process has become competitive with oxygen cutting for the processing of mild steel.

A research program was instituted to determine the factors which limited the usefulness of earlier plasma devices in cutting applications. A new principle of transferred-arc stabilization, developed during research on plasma cutting, allows for the use of much higher voltages and, consequently, much higher powers.

**Wall Stabilization.** Two basic techniques are used to stabilize the arc column in transferred-arc applications, Fig. 3. The first technique, wall stabilization, as reported in the literature, consists of a solid and a hollow electrode where, rather than constricting the arc, the geometry of the equipment is such that the plasma-forming gas becomes an integral part of the arc stream, which fills the nozzle from wall-to-wall.

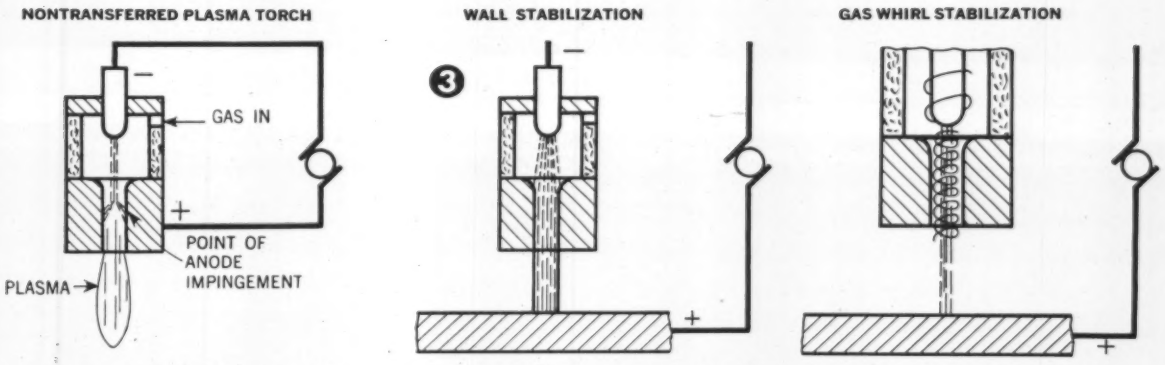
The nozzle passage acts to stabilize at least a portion of the arc. Thus the arc column is actually adjacent to the wall. An advantage claimed for this mode of operation (in comparison with the gas stabilization, to be discussed) is that the system can be operated in the absence of gas flow. For some transferred-arc applications, this is of great economic consequence. For metal-cutting applications gas momentum must be provided to "wash" the molten metal from the cut.

Unfortunately, wall-stabilized arcs are limited with respect to their voltage level of operation, suffering from the phenomenon of "double arcing," which is the establishing of two arcs in series—from cathode to nozzle, and nozzle to work—and which leads to torch failure.

**Gas Stabilization.** The second mode of arc stabilization utilizes a strong vortex gas whirl to position the arc column axially, and well away from the nozzle walls. When applied to the cutting of metals it allows the use of much higher voltages and powers than those available with wall stabilization.

### Cutting Experiments

A series of tests was made with gas-stabilized equipment which consisted of a standard F-40 Plasma System supplied with nozzles of varying diameters and lengths to cover a wide range of operating conditions. This torch was mounted on a conventional machine carriage.




the arc circuit is completed within the torch, the plasma being projected through the nozzle. For maximum heat-transfer rate the transferred-arc plasma is used.

**Fig. 3** The arc column can be stabilized in transferred-arc applications either by wall stabilization or gas-whirl stabilization. With wall stabilization the nozzle passage acts to stabilize at least a portion of the arc. Thus the arc column is actually adjacent to the nozzle wall. In the other method a strong vortex gas whirl is used to position the arc column axially and well away from the nozzle walls. It allows the use of much higher voltages and powers than those available with wall stabilization.

Where extremely high cutting speeds were required, tube sections of the desired wall thickness were mounted and rotated on a lathe. Speeds to over 500 ipm were obtained in this way. Higher speeds were obtained manually with stop-watch timing.

Mild steel, $^1/_2$ through 2. in thick, was used. Cutting speed was plotted against the power supplied to the torch, Fig. 4. Efficiency of conversion of electrical energy supplied to gas and anode heating averaged about 93 per cent (7 per cent loss to the cathode and nozzle). In all cases the plasma gas consisted of a mixture of approximately 70 per cent nitrogen, the remainder hydrogen. Not shown are curves for $^1/_4$-in. steel which was cut at 525 ipm at 115 kw using 240 standard cu ft per hr total gas flow, and $^1/_2$-in. steel, cut at 200 ipm.

For any one plate thickness and operating voltage, the data indicated a nearly linear relationship between cutting speed and power. It should be noted that the slope of the curves decreases for increasing thickness. This is probably the result of the increase of kerf width with the thicker sections of plate. Also, the voltage was maintained at an essentially constant value, varying between 220 and 270 volts. It is presently believed that the thicker sections require a higher voltage.

The maximum arc-cutting speeds attained to date are correlated with maximum recommended values for oxyacetylene cutting in Table 1. In each case the maximum speed is limited to that which will still produce a high-quality surface condition with minimum slag adherence. The relatively higher gas flows associated with the thinner plate are due to the high traverse speeds which require more of an atomization action than a "washing-out" of the molten metal.

**Table 1 Correlation of Maximum Plasma Torch Cutting Speeds Attained With Maximum Recommended Values for Oxyacetylene Cutting**

| Plate thickness, in. | Arc Torch | | | Oxyacetylene Torch | | |
|---|---|---|---|---|---|---|
| | Cutting speed, ipm | Kw | Gas flow, scfh | Cutting speed, ipm | Oxygen flow, scfh | Acetylene flow, scfh |
| $^1/_4$ | 525 | 115 | 240 | 26 | 70 | 14 |
| $^1/_2$ | 200 | 130 | 300 | 22 | 100 | 18 |
| $^3/_4$ | 100 | 130 | 230 | 20 | 120 | 18 |
| 1 | 80 | 130 | 230 | 18 | 130 | 18 |
| $1^1/_2$ | 50 | 150 | 230 | 16 | 170 | 25 |
| 2 | 40 | 150 | 250 | 13 | 230 | 25 |
| 3 | 20 | 210[a] | 250 | 10 | 270 | 32 |

[a] Limit of power supply.

Of particular importance in Table 1 is the reduction with increasing thickness of the plasma gas flow in comparison with oxygen and acetylene flows. For the 2 and 3-in. sections the total gas flow is actually less.

The minimum power required to cut mild steel at 20 ipm was 60 kw for 1-in. plate; 120 kw for 2-in.; and 180 kw for 3-in. In this case the quality of the cut surface was good, but not the equivalent of the "machine cuts" of Fig. 1 and Table 1. The relationship again appears to be linear. Extrapolation to 5-in. material indicates a power requirement of about 300 kw. It is probable, however, that to obtain a good cut in a 5-in. plate, the voltage should be increased to over 300 volts.

Cuts obtained for various thicknesses of steel are shown at the beginning of the paper. The cut surfaces are of good quality. Light slag adherence at the bottom edge has been tapped off. This slag is not nearly so adherent as that associated with oxygen cutting.

One great advantage of arc cutting over oxyacetylene cutting is its ability to sever all conducting materials. Aluminum, cast iron, copper, brass, nickel, and stainless steel are rapidly cut. Even tungsten is applicable to this process. Two-inch aluminum is cut at 120 ipm at 200 kw, $^3/_4$-in. copper at 80 ipm at 155 kw.

### Theory of the Process

The theory of arc-plasma cutting is not well understood and more fundamental research is needed. Voltage is of major importance. Runs were made varying the voltage from 140 to 240 volts on $1^1/_2$-in. plate, keeping the power level constant. The maximum cutting speed for the lower voltage was 30 ipm against 50 ipm for the higher value. In addition, the lower the voltage (particularly with thicknesses under 1 in.), the more V-shaped the kerf. Voltages over 200 produce vertical cut edges. Also, the higher the voltage (at least to those values used) the smoother the cut.

Ideally, the arc path should extend to the bottom of the cut. If the voltage is not adequate, the arc will penetrate only part way. The remaining thickness does not receive an adequate amount of heat; resulting cut is poor.

In addition to anode heating, an appreciable amount

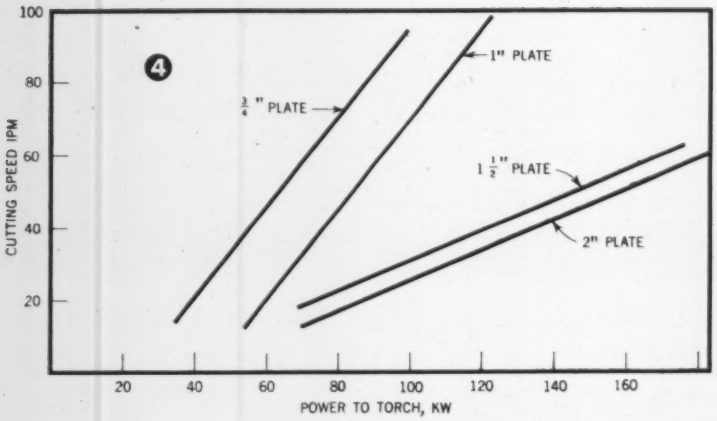



**Fig. 4** Cutting speed as a function of power supplied to the torch, with metal thickness the parameter. The voltage was maintained at an essentially constant value, varying between 220 and 270 volts.

# PLASMA-TORCH CUTTING

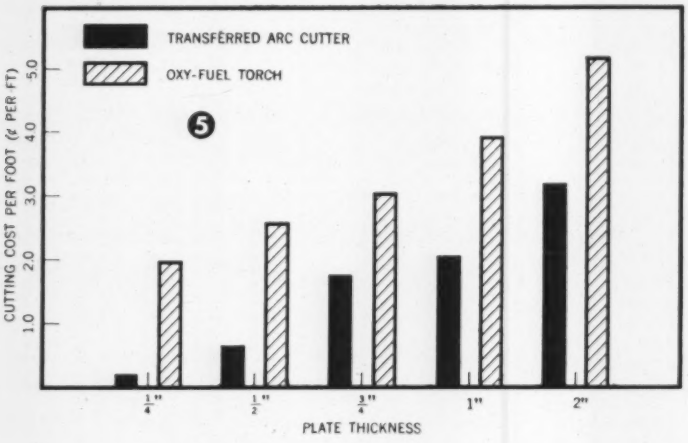



**Fig. 5** The cutting cost per foot of the transferred-arc plasma torch is less in all thicknesses than that for the transferred arc. The graph covers operating costs only and does not include overhead and amortization of the equipment involved. The costs per cu ft which apply are: 0.5¢ for oxygen, 0.08¢ for gas, 1.38¢ for nitrogen, and 2.00¢ for hydrogen. Power cost was 1.05¢ per kwhr and labor $2.00 per hr.

of the heat is transferred to the metal from the hot plasma. The higher the voltage at a given current flow, the higher the enthalpy of the plasma produced. With a flow of 250 scfh of nitrogen at a power level of 210 kw, the heat to the gas represents approximately 85 per cent of the total power to the torch, or 178 kw. This is an enthalpy of 2450 Btu per cu ft of gas, and the plasma temperature is estimated to be 25,000 F. It is impossible at the present writing to determine accurately the temperature of these hot plasmas. The thermodynamic data required for such a calculation are not available. In addition, the plasma is not at chemical or thermal equilibrium. Also, the conversion efficiency of 85 per cent, obtained for a nontransferred-arc torch operating at the same voltage level, may not apply for transferred-arc use where the anode is molten.

The fundamental data concerning electric arcs are usually associated with open arcs (arcs contained in a quiescent atmosphere). Plasma generators, as used for cutting, impose a Mach-1 flow of gas between the electrodes. This high a velocity is of the order of that of the heavier particles subjected to the temperature of the gas stream. It is thought that the flow of positive ions is seriously affected by this opposed high-velocity stream.

The economies of the arc-cutting process in comparison with oxy natural gas cutting are startling, Fig. 5.

As with any competing systems, all the advantage does not lie on one side. Oxy-fuel apparatus is simpler and much less costly. The kerf width produced by arc cutting is approximately double that of oxygen cutting. Sufficient experience has not been attained relative to the possible toxic effects of the plasma gases. Adequate ventilation is required. Cresswell discusses this problem and gas samples taken near the cutting region show that ventilation is adequate according to Code Z 49.1, pp. 8.2 and 8.3, American Welding Society tentative specification.

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The patent system now holds the place intended for it by such patent enthusiasts as Washington [1],[1] Jefferson [2], and Lincoln [3], themselves all inventors. A heavy responsibility rests on engineers.

# PATENTS and the Engineer

**By Alfons Puishes,** Mem. ASME, Patent Attorney, San Francisco, Calif.

THE stated purpose of our patent system, as found in the U. S. Constitution [4], may be summed up by two words: "Human betterment."

The broad field covered by engineering, touching as it does all facets of our modern life, finds its parallel in our patent system. This is true all the way from a typical patent on a chrysanthemum [5] to the cyclotron patent of Lawrence [6]; from a patent on a ladies' slip [7] to the nuclear reactor of Fermi [8]; from the two-page patent on the electric lamp of Edison [9] to the 700-page patent recently issued to Bell Labs on a telephone accounting system [10]; and back to the patent of King Gillette on his safety razor [11].

### Critics of the System

Critics of our patent system have pointed to the large number of patents that have been declared invalid by the courts. The concept of "patentable invention" has admittedly been a problem to our higher courts [12]. Thus the same court that upheld the patent on a flashlight battery which would not swell and disintegrate on use [13], invalidated the patent on the long-distance wireless telegraphy of Marconi [14] because it did not involve any "inventive skill." This decision prompted a vigorous dissent by Mr. Justice Frankfurter in which he stated, "It is an old observation that the training of Anglo-American judges ill fits them to discharge the duties cast upon them by patent legislation."

An attempt was made to remedy this situation in the Patent Law of 1952 [15], and while our courts have not been unanimous in carrying out what appeared to be the clear intent of Congress, there is a hopeful trend in the right direction [16].

The common cliché, "A patent is just a ticket to a lawsuit," is so trite as to be hardly worth mentioning. Any person who has suddenly acquired a valuable property right, be it by patent, inheritance, or otherwise, knows how easy it is to get involved in a lawsuit and no "ticket" is required. The inventor of a process which creates a stir in the marketplace, but who tries to operate in secrecy rather than avail himself of the protection of the patent laws, will soon see how easy it is to become involved in a lawsuit [17]. This is a problem of human nature and not engineering or patents.

A large segment of our well-meaning business community is so happy about the business which comes its way as the result of its excellent reputation and good-will that it feels no need for bothering with patents. If these gentlemen are in a competitive business which relies to any extent on the products of research, all they need is one experience which forces them to pay a royalty to someone else on something they themselves had previously invented and they will see how wrong they are [18].

Only two groups in our modern American society are justified in taking a strong stand against patents. The first is the extreme monopolistic businessmen to whom, since they already have or can readily acquire virtual monopoly in their field, the patents of others are a source of nuisance, while their own patents, largely defensive in nature, increase their vulnerability to attack under the antitrust laws [19]. The other group comprises the extreme left-wingers who would destroy all aspects of

[1] Numbers in brackets designate References at end of paper.

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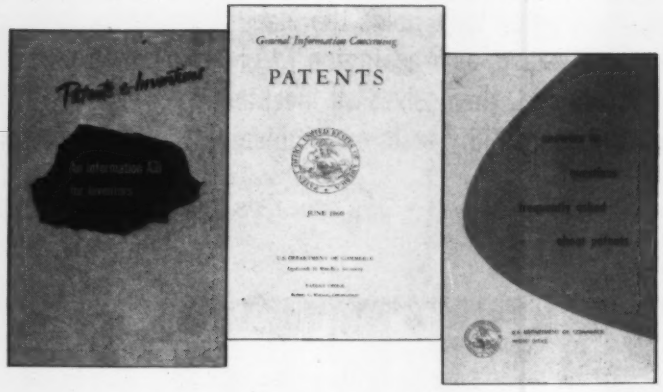
# PATENTS and the Engineer

More information? Write to Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.




private enterprise capitalism, including patents. These gentlemen are referred to comments on the Russian patent system given below [20].

### From Three Viewpoints

**The Engineer as a Researcher and Inventor.** The engineer-inventor of today should be reminded of the experiences of Watt [21], Fulton and Fitch [22], Morse [23], and Bell [24] with patents. Today's problems are essentially the same, only multiplied manyfold. The proper [25] and prompt [26] preparation and filing of patent applications as well as the keeping of complete records of research work [27] are more important now than ever before simply because of the much greater amount of research work now being done and the far larger number of patent applications being filed.

One of the important differences today is the role of the employee-engineer-inventor and his relationship to his employer, a problem often ignored immediately upon signing of the patent agreement [28], yet one which both employer and employee should review periodically to see that it is operating effectively and in justice to both parties [29].

Well over half of our patents today are issued to individuals as independent inventors rather than as employees of some organization. Some of the more noteworthy are the patents on Kodachrome, penicillin, xerography, the ball-point pen, the mechanical cotton picker, and the electron microscope [30].

**The Engineer as a Developer, Designer, Builder and Operator.** The modern engineer as a developer, designer, builder, and operator seems to have lost contact with the educational value of patents precisely at a time when this might well lighten his increased burdens. Nowhere—but nowhere—is there assembled such a wealth of technical information as exists in published U. S. patents now numbering close to 3,000,000. By collecting some of the basic patents in a given art at 25 cents each, the engineer will obtain one of the best bargains in technical literature available today [31]. It may require his familiarizing himself with the Manual of Classification [32], the Official Gazette [33], and other Patent Office publications, most of which are available in our bigger libraries. No engineer should be deterred by the legal jargon which he may encounter, and his familiarity with the engineering aspects of patents will certainly be greater than that of many attorneys practicing in the field. The time expended will be more than repaid by thus opening the door to a wonderful new source of concentrated information.

**The Engineer as a Manager.** The engineer-manager is concerned with the modern economic impact of patents. For proof that this has taken a sharp upturn in recent years and is now at a high level, consider a few of the large number of recent surveys and articles on the subject [34]. These are uniformly favorable with a few exceptions, such as the Melman report [35]. The latter is reminiscent of those harbingers of gloom who authored some of the economic reports so popular in the 1930's.

Most of the present-day hostility toward patents stems from the same source, and is in fact a remnant of the general hostility toward all forms of technological progress which was born of the thinking during the depression, when inventions, particularly of the labor-saving variety, were blamed for all our economic ills.

It is with another phase of the engineer as manager, or consultant to management, that one of our greatest problems lies today.

### Inventor's "Folly"

You will recall the story of "Fulton's Folly," or of how Alexander Graham Bell was unable to get financial support for a long time for his silly toy which was good only for talking from one room to another over a piece of wire, or how George Westinghouse and his air-brake were ejected from some of our best offices for insisting that he could stop a locomotive with "wind." To dismiss these incidents as ancient history and say that we are far too educated to indulge in anything like this today is dangerous complacency. This sort of thing is occurring this very minute, and today's engineers in management and consulting are about the only persons who can do much to correct it.

Dr. Robert Goddard tried to interest our U. S. Government in rocketry [36]. He was unsuccessful, and not until after the Germans came up with their V-2 did we take interest. Then we found that in trying to copy the V-2 we were in effect copying Goddard's patent which we had rejected, all to our own dismay and damage of $1 million [37].

Fermi, it is reported, offered the rights to his basic patent on nuclear transmutation to private organizations and to the U. S. Government for a nominal sum. No one in the U. S. wanted it. Much later, our Government went ahead and used Fermi's ideas in direct infringement

of his patent, resulting in a suit for $10 million, later settled for $500,000 [38].

The story of Christophilos and his particle accelerator patent is even more recent. His patent [39] was rejected without so much as a reasonable study, following which millions were spent, only to retreat in humiliation and adopt Chistophilos' invention [40].

The newspaper presses are still hot from running the story of the rejection of the Dean drive, or rising inertia platform, by our armed forces only to have Dean's patent issue and destroy any military-security advantage we might have enjoyed [41].

We are now engaged in a frantic effort to maintain our technological supremacy in the world by, among other things, trying to increase the numbers of our engineers. The "emphasis on engineering" has produced an "emphasis on education." To what avail is all this if, after our engineers produce great inventions, these languish unused even after they have passed the scrutiny of the Patent Office? One of the greatest responsibilities of engineering today lies in the recognition and utilization of good ideas when they are born.

### The Soviet Approach

Looking briefly at the Russian patent system, based on their new statute of 1959 [42], we note that they publish a "Byulleten Izobretenii" [43] (Bulletin of Inventions) twice a month which contains about 500 patents as compared to approximately 1000 per week currently appearing in our Gazette. Their principal type of patent, issued primarily to Russian citizens, is the "Avtorskoe Svidetelstvo" [44] (Authors' Certificate). The government, of course, gets all patent rights, and the inventor is rewarded in accordance with a generous schedule of cash awards plus other benefits based on the value of the invention to the government.

The Russians also issue the more conventional type of patent which they call "Patent" [45] and which is issued primarily to foreigners to whom the Russian Government agrees to pay a royalty.

Some of the more frivolous patents which appear in our Gazette are not evident in Russia, but all is not rockets and sputniks with Ivan. There are Russian patents on such capitalistic-type inventions as a musical ball [46], a method of making fancy tipped cigarettes [47], and a color television tube [48].

Under the Russian patent system the Government evaluates the invention, and the question of whether or not a patent will issue is governed not only by the usual requirements of novelty, utility, and invention, but also by the possibility that it will be economically advantageous and actually be put to use. Under the American system we issue the patent and leave the question of economic advantage and possible use up to the operation of our free, private enterprise system. A sound decision under either system must be based largely on engineering considerations. The basic responsibility under either system, as to whether an invention will be used or not, therefore lies with engineers.

### Calling All Engineers

It may be argued that engineers cannot be held responsible since, under the Russian system, they are governed by the orders of their political superiors, while in the United States they must follow the decisions of their banker-minded policy-making executives. If indeed engineers do not have enough voice in these matters, we can say that in the United States it is their fault for not organizing sufficiently to assume this leadership. It may be presumed that it is possible to do this in the United States but that in Russia it is not. Herein may lie the key to our ultimate victory. In any case, we wind up again with the emphasis on engineering.

Better protection and utilization of intellectual property, the product of a man's mind, are vital to our national survival.

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# A Review of HEAT TRANSFER Literature 1960

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## PART 2

**In heat transfer problems, what will you assume, what will you simplify, what ignore? In your results, how close will you come to reality? Heat transfer is perhaps the most difficult phase of our current technology.**

## Convection from Rotating Surfaces

By extending a previous analysis for a rotating disk, an approximate evaluation of the effect of curvature on the laminar heat transfer from a rotating spherical cap has been investigated [1G].[11] The theory, valid for large Prandtl numbers, allows an arbitrary meridional distribution of surface temperature. Another study [4G] relates to the heat transfer by laminar flow from a rotating sphere, and thus examines curvature effect.

A rotating disk with mass injection or suction at the disk surface [5G]: Laminar results are given for the velocity, temperature, and mass-fraction distributions as well as for the heat-transfer, mass-transfer, and torque requirements.

An infinitely long rotating circular pipe under the conditions of constant rotational speed and a constant axial temperature gradient [2G]:. The effects of compressibility are examined by considering the fluid to be a perfect gas. Another internal flow situation, the motion of a fluid inside a rotating annulus of square cross section, has been studied [3G]. The inside annulus dimensions are taken to be small compared to the distance from the axis of rotation, and the side walls are held at different constant temperatures.

The final paper in this series [6G] presents an analysis of the cellular motions within a horizontal rotating fluid layer which is heated from below.

## Combined Heat and Mass Transfer

Under the influence of the re-entry problem, a number of papers have been published recently which report mass-transfer experiments and design criteria for surfaces under the influence of large heat fluxes. Ablation characteristics of a number of plastics reinforced with inorganic fibers are reported in [20H]. The information which was obtained in a rocket exhaust is reported as "effective heats of ablation" for the various materials. This figure of merit represents the heat absorbed per unit mass of ablated material. A discussion [16H] is given of the agreement between experiment and various analyses when Teflon is exposed to the stagnation enthalpy and pressure levels encountered in hypersonic flight.

A simplified analysis is presented of hypersonic ablation [14H]. A calculation illustrates the change in shape of a hemispherical nose cone during re-entry. In [10H], the results of ablation tests in a plasma discharge of copper, aluminum, stainless steel, molybdenum, zircon, mullite, alumina, linen bakelite, nylon, and graphite are reported.

Ablation characteristics of clear and opaque quartz were determined experimentally in an air-arc wind tunnel [2H]. Data are compared with the analysis of Bethe and Adams. Another analysis takes up stagnation-point melting-ablation [1H]. In a paper considering sublimation in a hypersonic environment [15H], the pertinent equations are derived for the simultaneous processes of diffusion, convection, and thermal exchange and applied to the vaporization of a refractory material.

A series of studies deals with mass injection into turbulent boundary layers. New experimental results [4H], with refined radiation-conduction corrections over previously published results, indicate that the Rubesin analysis tends to overestimate the reduction in Stanton

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[11] Numbers in brackets designate References at end of paper.
Contributed by the Heat Transfer Division of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. See July, 1961, issue for Part 1.

number from blowing. Another experimental study [18H] reports on sublimation mass transfer from an adiabatic sharp-edged flat plate under free-stream Mach numbers of 0.43, 2.0, and 3.5.

A study of available experimental data evaluates various turbulent theories [8H]. Particular attention was given to the influence of the molecular weight of the injected gas on the reduction in Stanton number. An analysis [21H] is presented for injection into an incompressible turbulent boundary layer under the hypothesis that the effect of injection is restricted to the sublayer region.

A two-dimensional Laval nozzle with nitrogen injection into a nitrogen-free stream [7H]: Experimental heat-transfer measurements are compared to Rubesin's turbulent theory. A series of measurements has also been made [13H] of the skin friction in a compressible turbulent boundary layer on a cone. Injected gases into an air free-stream consisted of helium, air, and Freon 12.

An experimental study is reported [12H] of the effect of slot injection angle in film cooling effectiveness. Data were obtained from normal hole configurations and angled slots. The effect of shock-generated vorticity on mass-transfer effectiveness has been investigated [9H].

A laminar analysis of helium injection into air considers the effect of a free-stream pressure gradient [3H]. The influence of the pressure gradient on both the skin friction and heat transfer was investigated. Another laminar analysis [6H]: The case where there is constant injected mass flux at the plate surface. This condition is compared to the previous cases of either a blowing velocity distribution that yields a constant surface temperature, or one of uniform blowing velocity. Solutions are presented [5H] for the compressible laminar boundary layer on yawed cylinders with transpiration cooling.

An unusual mass-transfer condition [17H], where the injected velocity was as large as 19 times the free-stream velocity: This was done by examining an evaporating liquid into a low-speed inert gas at pressures near the vapor pressure of the liquid. Another study [11H] examined the effect of a deceleration force on a melting boundary layer which opposes the downstream flow of the liquid.

The reader's attention is called to a summary article by Professor D. B. Spalding entitled "Heat and Mass Transfer in Aeronautical Engineering" [19H]. Utilizing the mass-transfer literature, Professor Spalding develops design procedures for a number of specific technical problems. Typical of the problems considered are the calculation of the rate of burning of a graphite heat shield and the rate of enlargement of the throat area of a solid-propellant rocket motor having a graphite nozzle.

## Change of Phase

To gain understanding of the boiling mechanism, experimental studies have examined bubble mechanics. Photographic evidence of nucleate boiling in a rectangular cross-section flow channel yields expressions for bubble growth, collapse, and distribution of maximum bubble diameters which are related to bubble energy transport [33J]. Examining the problem of bubble formation in superheated liquids and drops, [22J] reports data and correlations useful in predicting conditions required for homogeneous nucleation, while [4J] gives measured bubble growth in various superheated liquids. Using aqueous solutions of surface-active agents, bubble formation was observed and the increased boiling coefficient attributed either to a decrease in dynamic surface tension or an increase in active nuclei in solution [14J]. High-speed photographs show generation and growth of bubbles from a single orifice source in a liquid $N_2$-$O_2$ mixture [6J].

A step toward the economic recovery of fresh water appears in the use of thin, evaporating, and condensing films to yield over-all heat-transfer coefficients as high as 8000 Btu/hr/ft$^2$/F [21J]. Heat-transfer coefficients for film boiling of Helium I from a single wire agree with those for other liquefied gases [7J]. The forced vaporization of water, carbon tetrachloride, benzene, methanol, and n-butyl alcohol in a tapered tube permits the influence of evaporation area to be evaluated [5J], and natural-convection boiling results for liquid Freon 12 in a single tube appear in [20J]. Using a hydrodynamical model, [36J] examines transition of water from bubble to film boiling for various values of pressure, water velocity, and subcooling. Liquid superheating shows influence on boiling coefficients [34J, 16J] depending on presence or absence of bubbles from active sites determined by surface roughness [16J].

Analytical efforts consider the hydrodynamic boundary condition (i.e., temperature jump and pressure deviation from equilibrium) for evaporation and condensation [15J] and vaporization processes in the hypersonic, laminar boundary layer for a vehicle of arbitrary material [25J]. The correlation of existing data yields generalizations of heat transfer for nucleate boiling [23J, 18J].

Evaporating liquids into low-speed, inert-gas streams at pressures nearly that of the liquid vapor pressure shows the influence of high concentration gradients and evaporative velocities on mass-transfer rates for the Graetz number range 0.1 to 1800 [26J]. Observation of rates of evaporation of drops containing dissolved solids in a hot air stream affords a basis for predicting spray-dryer performance [3J]. Evaporation rates predicted for small drops (diameter of order of mean-free-path of steam molecules) compare favorably with experimental data and suggest valid use for larger drops [8J]. Further drying implications are inherent in the examination of convective heat exchange between a current of hot air and a flat, wet surface [13J]. Reference [30J] attributes the diminution of humidity of porous materials in the presence of water-saturated atmospheres to capillary effects. The application of energy and mass-transfer equations permits an accurate estimate of the reduction of evaporation from a water surface caused by the application of a monomolecular film [11J].

Continuing earlier work in condensation, [19J] compares theoretical equations with experimental data for laminar and turbulent film condensation and introduces correction factors (accounting for effects of liquid inertia, convective transport, wave motion, and variable properties) which give good agreement. Also part of a continuing study is the determination of the influence of vapor drag on heat transfer during condensation for

Prandtl numbers 10 and 0.008 [28J]. Considering the inertia forces and energy-convection terms neglected by Nusselt, [29J] performs a boundary-layer analysis of laminar-film condensation on a horizontal cylinder and reports heat-transfer results for the Prandtl number range 0.003 to 100.

Factors examined for the influence they exert on condensation are (*a*) crossflow in the case of steam and steam-gas mixtures condensing on a vertical tube [9J], (*b*) geometry in the case of Freon 22 condensing on the outer surface of single, horizontal, smooth, and ribbed tubes [27J], and (*c*) viscosity of condensate (water and glycerine) [37J]. Reference [10J] presents experimentally verified equations for calculating water vapor transfer through composite walls.

Burnout heat flux: The influence exerted by nonuniform, peripheral heating of steam-water mixtures in vertical tubes [31J]. Further data [1J] for water in a vertical tube (8.2-mm ID) at varying pressures (20 to 300 atm), subcooling (0 to 140 C), and tube length (35 to 135 mm) disagree on several counts with previously published data. For the vertical upflow of water in uniformly heated rectangular tubes, burnout heat-flux data at 2000 psia show correlation with fluid-mass velocity and burnout enthalpy [2J]. Further comparisons of tube-burnout data for boiling water are made in [32J]. Experiments showing the hydrodynamic instability of a two-phase layer are related to burnout heat flux and afford a predictive criterion [17J].

Ablation of solids (naphthalene and camphor spheres) receives photographic study in [35J, 38J], leading to the determination of local ablation rates for Reynolds number range 120 to 16,500. Analytically, [24J] examines the unsteady mass loss and energy accumulation caused by aerodynamic heating of blunt bodies.

Reference [12J] reports measured heat and mass-transfer rates for the interesting case where a weak $NH_3$ in water solution flows down the outside of a water-cooled tube while absorbing anhydrous $NH_3$ at 1 atm.

## Radiation

A feature of the past year's radiation literature has been the number of papers concerned with radiation heat exchangers and the equilibrium temperature of objects in space. Some deal with a single fin exchanging radiation with specified black environment, and one paper presents an exact formulation of the multifin radiation problem.

The radiation-fin efficiency for a single circular fin has been studied [9K] under the conditions of no incident radiation. Companion papers [23K, 2K] investigate a radiating rectangular thin fin which is irradiated by a uniform source. Optimum fin geometries for minimum weight are investigated. Another paper [36K] reports on the same problem with the inclusion of a discussion of meteorite puncture probabilities. Two papers [38K, 25K] discuss the important problem, as far as space applications are concerned, of the best shaped radiation fin of minimum mass. An exact formulation of the problem of radiating fins with mutual irradiation as well as radiant interchange with nearby surfaces and the environment is presented in [14K].

A unique type of heat exchanger for space applications is described in [37K]. A rotating circular belt picks up waste heat on one point on its circumference and radiates this heat to a sink in its travel around the periphery. The analysis of the temperature distribution in a rotating cylindrical shell which is heated on one side by the sun in space is given in [11K]. A transient analysis of a similar geometry in space but without rotation and having a specified infinite thermal conductivity is reported in [28K].

Selective nongray coatings which have a different absorbtivity for solar radiation from their emissivity value: The use of such coatings for the temperature control of satellites is discussed in [16K]. Another paper [21K] describes the preparation and high-temperature stability of selective coatings that will withstand surface temperatures up to 1000 C.

The general problem of radiant interchange within an enclosure: A series of three papers [5K] presents an analysis of this situation using the radiation network method. The radiation characteristics of long cylindrical cavities have been determined by numerical solutions of the governing integral equation [31K]. Thermal radiation between infinite parallel plates separated by an absorbing and emitting gas is described in [35K]. Equations of radiative transfer in gases are formulated for the one-dimensional case to include radiation exchange with solid boundaries [15K]. An example of the solution of these equations is given for an infinite flat layer of gas bounded by parallel plane surfaces.

The four-dimensional heat-flux integral for diffuse radiation between two surfaces separated by an absorbing gas [26K]: The complex integral is transformed into a sum of one-dimensional integrals for the case of opposite-parallel and adjoining-perpendicular rectangles. Analytical relations have been obtained [20K] which suggest an experimental procedure for the determination of radiation geometric factors as well as the radiation properties of the surfaces involved.

A new approach to the formulation of the radiation transport equation [12K]: The method involves replacing the standard spectral absorption coefficient with an error function absorption coefficient.

A "three-measurement" method of measuring the spectral emissivity and temperature of solid surfaces [33K]: Involved in the procedure is a simultaneous determination of the brightness and color temperatures at three wave lengths. Another interesting experimental paper [32K] describes a high-speed bolometer for measuring large incident radiation fields such as those coming from nuclear fireballs. The response time of this instrument is of the order of 50 microsec.

The normal spectral emissivities of ceramic-coated and uncoated specimens of inconel and stainless steel [27K]: The measurements were made at temperatures of 900, 1200, 1500, and 1800 F over a wave-length range of from 1.5 to 15 microns. Spectral radiation properties have also been reported [13K] for a number of fabric materials from 1.0 to 23 microns. Materials examined included cotton, linen, silk, orlon, and nylon.

A transient technique for measuring the total hemispherical emissivity of highly polished metals [8K]: The apparatus, which can be operated from 100 to 900 C, has an accuracy of 8 per cent. It can also determine the specific heat of the material to within ±2 per cent. The analytical solution of a constant-area fin radiating into a low-temperature environment has been utilized to design an experimental apparatus to measure the total hemispherical emissivity of polished iron in the temperature range from 300 to 500 R [7K].

Two papers deal with unsteady heat conduction in a solid with a radiation or nonlinear boundary condition. The transient temperature field in an infinite slab with radiation cooling at the surfaces is solved by an integral approach in [29K]. Another study [10K] considers a semi-infinite solid with a nonlinear transfer process at the surface. As an example, the temperature distribution in the solid is determined under the conditions of Stefan-Boltzmann radiation at the surface.

Radiation in diathermanous materials such as glass [24K]: Analysis and experiment are coupled to investigate the temperature distribution in the glass. Another paper dealing with the same subject [4K] presents a calculation of the spectral radiation emitted normally from the surface of a thin sheet of glass. The results of the calculation are used to design a pyrometer to measure glass temperatures.

The influence of internal radiation exchange in the reduction of temperature differences in solid structures: A transient analysis [3K] investigates the structural temperature distribution under the conditions of external convective heating. Simple models such as parallel plates are used in [1K] to evaluate the same effect.

The subject of radiative transfer through particulate media: Radiant transfer through fibrous and foamed insulating materials was investigated theoretically and experimentally in [22K]. The optimum diameters of fibers and pores were determined for minimum radiative transfer over the temperature range from 200 to 800 F. A related study [17K] reports on radiative transfer between discrete solid particles in a bed. A theory is presented which accounts for different particle geometries.

The analysis of laminar compressible flow in the stagnation region has been modified to examine the effects of foreign-gas injection from the surface [18K]. Another analysis [6K] deals with the effect of thermal radiation on the inviscid flow over a blunt body.

An experimental investigation [19K] on the effect of injection of carbon black on the radiation properties of flames: It was found that such injection produced a significant increase in flame emissivity.

The use of the calculus of variations as a tool in radiation analysis [30K]: An example is given of the application of this method to the case of two finite nonblack parallel plates, and a comparison is made with the exact solution. Among other solution techniques, the variational method just described is utilized to examine the thermal radiation from a finite cylindrical enclosure with a specified wall flux [34K].

## Liquid Metals

A survey covering the current state of knowledge in liquid-metal heat transfer [3L]: The large spread among data for tube and duct flows which was highlighted in the 1955 Lubarsky-Kaufman survey remains. Information on free convection, boiling, and condensation is given, but in the latter two areas the data are sparse.

The lack of agreement between theory and experiment is sometimes ascribed to the existence of a surface contact resistance. A static experiment using mercury and chrome-plated copper finds a resistance too small to explain the discrepancy [6L]. In response to reactor applications, information on the maximum temperature in a tube or annulus having a longitudinally varying sinusoidal wall heat flux has been obtained by correlating mercury data [7L]. Nucleate boiling of mercury (with wetting additives) in a natural convection loop achieved heat fluxes of 600,000 Btu/hr $ft^2$ without yet reaching the critical value [9L]. Another boiling study is reported [4L], but a translation could not be found.

Tests and operating experience on heat exchangers utilizing NaK with air or a molten salt are described [5L], and design precepts based on this knowledge set forth [2L]. A feasibility study relating to boiling mercury under zero gravity was carried out in an airplane flying a zero-gravity arc [8L].

An analytical study led to the conclusion that the effects of variable fluid properties on liquid-metal heat transfer in tubes is moderate and is not the cause of discrepancies among data [10L]. A modification of Prandtl's mixing length theory is applied to the analysis of turbulent tube flow [1L]. The final equation for the Nusselt number contains a separate dependence on the Prandtl and the Peclet numbers which is neither supported nor refuted by currently available data.

## Low-Density Heat Transfer

Experimental and theoretical efforts focused on heat transfer between simple geometries (cylinders and spheres), and high-speed, rarefied gas streams. This concern arises from technological needs of missile, satellite, and space vehicle design.

Experiments with chromel-alumel wires in cross flow at about Mach 6 covered a Knudsen number range of 0.001 to 15, and yielded Nusselt numbers 0.01 to 10 and accommodation coefficients of 1.0, 0.9, and 0.4 for argon, nitrogen, and helium, respectively [9M]. Another study [8M] gave similar results for a 0.5-in. cylinder in continuum and slip-flow regimes for the Mach range 1.3 to 5.7. Measuring the heat loss from thin wires ($L/D \gg 1000$) in the transition regime showed the effect of wire diameter [2M]. Collecting new and existing data, [1M] reports a general Nusselt-number correlation for transverse and yawed cylinders in continuum, slip, and free-molecule air flow at subsonic and supersonic conditions, the results covering a Knudsen number range $4 \times 10^{-6}$ to 37 and a Mach range 0.001 to 6.0.

# HEAT TRANSFER

Application of the complete Navier-Stokes equations to the viscous layer—thin shock and the merged layer—thick-shock portions of the transition regime gave heat transfer rates in the stagnation region of adiabatic and highly cooled spheres and cylinders in hypersonic flows [6M]. Considering a hot wire in forced convection with a low Mach number stream, [5M] obtained Nusselt numbers reasonably accurate throughout the transition regime. Introducing slip and temperature jump into an incompressible shock-layer analysis, stagnation-point heat transfer for blunt bodies in hypersonic streams approaches boundary-layer predictions [4M]. Solutions of the Boltzmann equation for parallel-plate heat transfer throughout the transition regime are compared with other predictions [3M] and a useful review [7M] cites investigations, kinetic-theory developments, and salient features of the free and nearly free molecule flow regime.

## Measurement Techniques

New techniques for temperature measurement have been proposed. An absolute noise thermometer has been developed [7N] in which use is made of the relation between temperature and thermal noise, measured electrically, in a resistor.

The accurate measurement of surface temperatures of solids at temperatures in excess of 1500 K has long been a difficult experimental problem. It has been proposed [14N] that measuring the velocity distribution of a beam of atoms which has been reflected from the surface offers a promising method. It appears that the reflected beam is in temperature equilibrium with the surface over a wide range of surface types, smoothnesses, and temperatures.

Another paper [12N] discusses the relative merits of thin-film probes versus hot wires. The film probe has the advantages of ruggedness and low sensitivity to contamination products in the gas stream.

The measurement of thermal properties: An apparatus has been developed [17N] for the determination of thermal-expansion coefficient, specific heat, and thermal conductivity of refractories to temperatures up to 3650 C. Another device [9N] measures the thermal conductivity of insulating materials from liquid nitrogen temperature to room temperature. A special feature is the short time necessary to reach thermal equilibrium.

Ångstrom was the first to show that, by subjecting one face of a material to a time-dependent and cyclic temperature pulse, its thermal conductivity could be determined if the amplitude and phase of the pulse were measured at two interior points. This method has been adapted to measure the thermal conductivity of semiconductors [8N]. Thermal measurements of diathermanous materials in which more than one mode of heat transfer prevails are particularly difficult. A study [2N] deals with the determination of thermal conductivities of transparent substances.

The last paper in this series [6N] deals with a probe for measuring the thermal conductivity of building materials. The probe is only 0.11 in. in diam and may be used to determine the thermal conductivity at locations in the cross sections up to about 1.2 in. below the surface.

Another group of papers is concerned with errors in temperature measurements. Errors involved in measuring boundary-layer temperatures because of conduction down the leads are studied in [18N]. A similar study [5N] discusses the effect of lead-conduction errors when making ground-temperature measurements in geological researches. A third paper [1N] presents an analysis of the errors when a thermocouple is placed beneath the surface to measure surface temperatures. Considered: The disturbance in the temperature field caused by the presence of the thermocouple, and the effect of having the thermocouple removed a distance from the surface.

A method of measuring temperatures downstream from a shock wave [13N]: The technique is based on the use of the emitting and absorbing characteristics of sodium D lines. Temperatures from 4000 to 5000 K were measured under laboratory conditions with an error of from 100 to 200 K. A probe for the measurement of gas temperatures [23N]: Probe errors of radiation, base conduction, and thermocouple-wire conduction are minimized by electrically heating the probe base and shield.

Transient temperature measurements [16N] and [3N]: In the first paper, a thermocouple installation measures the temperature change on the cylinder-wall surface of an internal-combustion engine. The second paper [3N] discusses a special thermocouple plug developed to measure transient temperatures at relatively large distances from the surface within rocket-nozzle walls.

Two thermocouples suitable for the measurement of temperatures up to 2800 C are described in [4N]. Important features are the suitability for operation at higher temperatures than is possible for existing thermocouples and their high sensitivity. A quick connector for multipoint thermocouple assemblies [11N] is easily constructed and affords protection against factors which affect thermocouple calibration.

An improved method for measuring turbulence in wakes [10N] uses a condenser-type microphone and a hot-wire anemometer. Results of measurements made with this instrument indicate the contribution of pressure fluctuations to the turbulence characteristics. Another experimental investigation [21N] relates to the effect of relaxation times on impact-probe measurements.

Two new techniques for making flow measurements: The use of nuclear resonance detection in tracers [19N]; this technique offers promise in measuring flow rates in blood vessels where conventional methods are difficult to apply. By x-raying with a narrow beam [15N] it is possible to measure both the average vapor content in a channel cross section in two-phase flow and the local vapor concentration in a small portion of a boiling-layer.

A pair of general papers complete this section. The first [20N] is a convenient listing of papers in the literature which describe pitot and static probes, their origin, principles, evaluation, performance, modern modifications, and applications. The last paper [22N] gives a complete description of a temperature standards laboratory. A complete list of all the instrumentation is included as well as the accuracies obtainable in the different kinds of calibrations.

# Heat Transfer Applications

**Heat Exchangers.** Interest remains high on the transient response of heat exchangers. The last paper of a three-part series [1P] presents a general solution for the transient temperature distribution resulting from an arbitrary time rate of change of heat generation starting from an arbitrary initial condition. The relative merits of "exact" and numerical solutions are presented ably and cogently by adherents of both viewpoints.

Another paper [9P] investigates the transient response and the steady-state behavior of a solar heat exchanger wherein the energy transfer processes are by radiation.

Experimental data on the effect of flow pulsations on the efficiency of shell and tube heat exchangers [2P]: Pulsation frequencies of 40, 80, and 160 cpm are applied over a tube Reynolds-number range from 4000 to 50,000.

Two types of special-purpose heat exchangers [3P, 10P]: The first are nuclear-reactor heat exchangers which operate with power densities up to 10 megawatts/ft$^3$. Under these severe conditions, critical problems are thermal stresses and methods of metal fastening. The second paper presents heat-transfer and pressure-drop data on heat exchangers involving liquid metals and molten salts on the two sides.

Another pair of papers deals with artificial methods of increasing heat transfer. The study of mechanical wiping on surfaces of evaporation [7P]: Analysis which is substantiated by experiment shows large increases in heat transfer over conventional surfaces. The second paper [8P] reports an investigation of the effect of turbulence promoters in three typical heat-exchanger designs.

Tube sheets of U-tube and bayonet-tube exchangers have been investigated for the strengthening effect of tube-bending reaction [4P]. This effect is evaluated and presented in the form of simple design factors. A regenerative pebble-bed heat exchanger has been constructed to produce large quantities of high-temperature air [6P]. Data have been obtained on both the air and bed temperature distributions and compared with predicted values.

Heat-transfer and friction characteristics of compact heat exchangers [5P]: The exchangers examined have the longest surface-to-volume ratio of any investigated thus far in the program at Stanford University.

**Aircraft, Missiles, and Satellites.** In aeronautics, interest has now shifted to an analysis of the re-entry conditions through the atmosphere of manned and unmanned satellites. It is concluded [4Q] that either a blunt, dense vehicle with an ablation cooling system, or a radiation cooled vehicle with drag break or lifting surface, is best suited for this purpose. Simple procedures for a surface temperature prediction have been developed [5Q, 8Q, 2Q, 3Q, 1Q]. These studies consider entry into the atmospheres of other planets as well. The possibility of simulating atmospheric re-entry conditions in experiments with small scale models has been investigated; such a simulation is possible as far as the thermal stresses and the skin temperature are concerned [10Q]. The chemical decomposition process on an ablating teflon wall is investigated [9Q]. Film cooling with water is proposed for the re-entry of satellite vehicles, and experimental results are reported [7Q]. Temperature conditions in orbiting satellites are essentially determined by the radiation to and from the surface and by internal conduction and radiation processes. The thermal control of the explorer satellites is described and analyzed [6Q].

# Thermodynamic and Transport Properties

Experimental and theoretical efforts extend from cryogenic to plasma temperatures for a variety of fluids.

**Thermodynamic Properties.** Investigation of the *P-V-T* behavior of water and steam [13R] obtained data in the pressure range 700 to 900 Kg/cm$^2$ and temperature range 650 to 700 C, accurate to 0.06 per cent. Compiled and correlated data for helium resulted in *T-s* and *h-s* charts for the temperature range 3.0 to 20 K, and pressure range 0.5 to 100 atm [14R]. Use of statistical mechanics [20R, 6R] predicts equilibrium air properties for temperatures 500 to 15,000 K, and pressures from 0.0001 to 1000 atm. Reference [7R] reports similar data for nonionized $N_2$-$O_2$ mixtures to 10,000 K. Hydrogen data from 600 to 5000 K and 0.01 to 100 atm are compiled for calculating rocket performance [12R].

**Transport Properties.** Employing hot-wire techniques, [22R] reports thermal conductivities for the monatomic gases—He, A, Kr, Xe, Hg(vapor)—from 0 to 500 C at 1 atm with a maximum error of 1.8 per cent while [4R, 3R] finds that the $N_2O_4 = 2\ NO_2$ system has conductivities 9 times that computed for equivalent nonreacting systems in the region 20 to 215 C and 0.02 to 1 atm. Coaxial, cylindrical cells yield thermal conductivities of air, A, $N_2$, $CO_2$, and steam to 900 C at 1 atm [21R], liquid and gaseous $N_2$ and A in the region 85 to 200 K and 1 to 135 atm [3R], and $D_2O$ in the region 75 to 260 C and 24 to 294 atm [24R]. Reference [5R] reports direct Prandtl measurements for He-air mixtures at 270 K.

Absolute viscosities for air, A, $CO_2$, $D_2O$, He, $H_2$, Kr, Ne, $N_2$, $O_2$, and $H_2O$ (vapor) at 20 C by the oscillating-disk method are reported accurate to 0.05 per cent [10R] and the soundness of the method further verified [11R].

Statistical-mechanics methods applied to air [6R, 2R] supply estimates of transport properties, from 500 to 15,000 K, and from 0.0001 to 100 atm, useful in hypersonic laminar boundary-layer applications [19R]. Based on the Lennard-Jones potential, transport properties from 200 to 1500 K are estimated for He-air mixtures at low pressures [5R] and for the atmospheres of Venus, Mars, and Jupiter [8R]. Reference [12R] reports equilibrium, hydrogen transport property predictions for the temperature range 600 to 5000 K, and warm plasma (an equilibrium mixture of plus ions, neutral particles, and mobile electrons) conductivity is predicted in [17R].

# HEAT TRANSFER

For point-source diffusion, [18R] reports the effect of concentration-dependent coefficients on the concentration distribution in one, two, and three dimensions, while [1R] notes that diffusion coefficients may be calculated from the change of asymmetric concentration profiles over known distances.

Microscopic behavior at elevated temperatures: [16R] reports collision integrals for the exponential repulsive potential and [15R] the effect on these of excitation and charge exchange in mixtures, both important in predicting the transport properties of gases at high temperatures. A useful review of molecular transport properties of fluids is given by [9R].

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Abstracts and Comments Based on Current Periodicals and Events

# BRIEFING THE RECORD

## Industry Goes Underground

THE Brunson Instrument Company, manufacturers of high-precision optical tooling and surveying instruments, has moved its entire operation from a conventional plant to a large limestone cave. From all indications this change has proved both practical and economical.

In their new location they are no longer troubled by the dust, noise, moisture, and ventilation problems they formerly had. With their machines mounted on solid rock, vibrations which had interfered with machining and testing operations in the old plant are no longer a problem.

The facilities, which are nearly finished, house a complete operation from offices to heavy machinery in the 125,000-sq-ft cave. Basically, the plant consists of six tunnels, 30 ft wide by 525 ft long. These tunnels run east and west with a 45-ft center-to-center distance. Intersecting north-south tunnels are 30 ft wide with an interval of 90 ft. Ceiling height is about 12 ft.

The present plant site, which is only a few minutes from downtown Kansas City, was originally a limestone quarry. So, to create space for the plant, the company had to go into the limestone business. They were able to sell the rock and pay for two thirds of the plant, excluding the cost of the land. Over-all, the plant cost about $6 per sq ft as compared to $12 per sq ft for a similar above-ground installation.

Because of this unique construction, the entire plant is virtually fireproof. Aside from the rock walls and pillars, all divisions in both the office and factory areas are made with panels of gypsum board and aluminum. In addition to being easy to move, these panels pose very little fire hazard. As a result, the insurance rate is less than 20 cents per $100. (The rate at the downtown building was $2.85 per $100.)

To get away from the hazard of dust, both walls and ceiling have been coated with Texolite sealer.

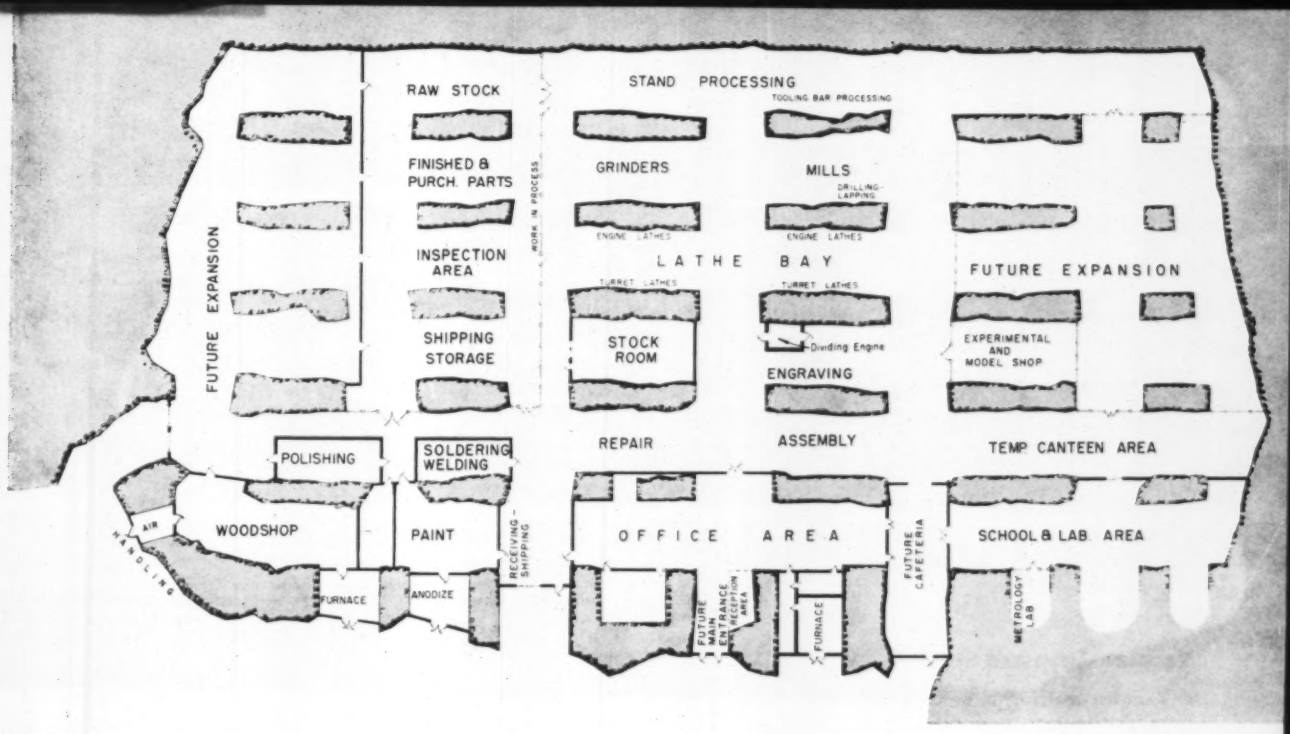
Although the move was prompted mostly by economics, the plant is safe in the event of war. It has been estimated that nothing short of a direct hit with a hydrogen bomb would seriously harm the installation.

There are from 45 to 77 ft of shale, limestone, and soil between the plant ceiling and the surface. The factory proper is quarried in the bottom 12 ft of a 21-ft seam of limestone. With a solid 9 ft of limestone above the ceiling there is no need for metal pins to prevent ceiling falls.

This is an underground working area at the Brunson Instrument Company. Space for the entire operation has been blasted from solid limestone. Diagram, **opposite page,** shows the plant layout with the solid areas indicating surrounding limestone walls and supports.

The complete plant and office area are air conditioned and humidity controlled. At present there are two air-conditioning systems installed and in operation. (The use of the term "air conditioning" is a little misleading. Actually, the air-conditioning equipment is used only for humidity control. The average wall temperature at the time the plant was complete was 54 F. It is only necessary to bring the wall temperature up to a constant value.) A 50-ton air-conditioning unit in the shop area can supply 16,000 cfm. Air to the shop area is fed through ducts down the central aisle running north and south and returns to the air conditioner over the top of the office section. Thus it is a center-feed, side-return system.

The office area has its own separate $7\frac{1}{2}$-ton air-conditioning unit for humidity control and a separate furnace for heating with a 120,000-Btu capacity. Two 240,000-Btu heaters are sufficient for the complete factory area.




All air which goes through the air-conditioning systems or the furnaces, regardless of whether it is fresh or recirculated, is filtered prior to going through the equipment. The 50-ton shop unit is capable of removing more than one pint of water every 11 sec.

At present, all electric power for the manufacturing facility is supplied by three 100-kva transformers. The location of the present power input is close to the center of the plant. Additional power input facilities are being provided to allow for supplementary power sources should the need arise.

The cave is dry and leaks are rare. But, when a leak does occur, they bore down from the top, meet the leak, and plug it with a compound that expands and hardens.

Although this is a totally new environment for the workers, there has been little employee resistance to working underground. Many have, in fact, commented that working conditions in the cave were much better than they had experienced elsewhere.

## Niagara Hydro Plant

When completed, the Niagara Power Project will have a total capacity of 3,030,000 hp or 2,190,000 kw. This is said to be the largest hydroelectric installation in the western hemisphere.

The $720-million project, which was financed entirely by bonds, will be completed by December, 1962. The first unit went into commercial operation at the end of last January.

The project consists of the Robert Moses Niagara Power Plant, the Reservoir Pumping and Generating Plant, and the Niagara High Voltage Switchyard. All are located in Lewiston, N. Y.

About three miles from the Falls and directly opposite the Sir Adam Beck II Station of the Ontario Hydroelectric Company is the Moses Generating Plant. It will house 13 vertical hydraulic turbines, each with a 200,000-hp capacity. Generators will be rated at 167,000 kva. Gross available head of the plant is 314 ft.

The Reservoir Plant is on a plateau at the upper terminus of the surge basin. An intake structure has been built on the Niagara River about three miles above the Falls with two water conduits, 66 ft high, 46 ft wide, and four miles long carrying water from the river to the 60,000-acre-ft reservoir. The Reservoir Plant has been designed as a peaking plant where generator/motors will pump water into the reservoirs when not used as generators.

Purpose of the third section, the Niagara Switchyard, will be to firmly link the new system with the Niagara Mohawk, Rochester Gas & Electric, New York State Electric and Gas, and Ontario Hydro Power Systems.

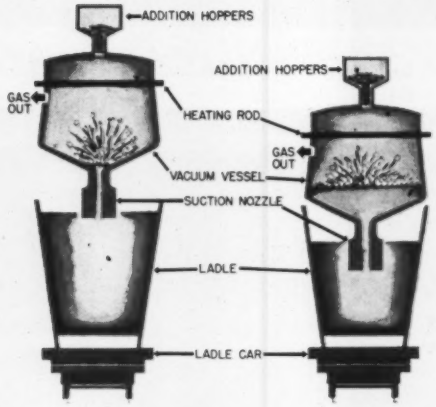
## Precision Parts Measured

A 16-ton, tape-controlled system can complete almost 1000 precise measurements in two hours. The system, developed by The Sheffield Corporation, a subsidiary of The Bendix Corporation, is being used to measure critical missile components. To take the measurements by other means would require about a month. The gage can detect a change of 10 one-millionths of an inch.

The universal, 5-axis machine can quickly locate an almost microscopic spot where a missile part might be out of tolerance. It simultaneously measures the inside and outside dimensions or the contour of a part, determines wall thickness, and prints the results as well as giving a visual read-out.

"Electronic fingers" do the measuring. They are devices so sensitive that their movements can be amplified electronically 10,000 times. If necessary, 100,000 precision readings can be taken on a single inch of a part under inspection.

This device is said to be the forerunner of several huge measuring devices which will permit fast, accurate tolerance control of industrial components.




The Dortmund-Horder unit carries out a vacuum degassing process which removes harmful impurities from steel. In the vacuum vessel, gases are removed and alloying materials added.

## Vacuum-Degassed Steel

VACUUM melting is used in a number of processes to improve the quality of steel by reducing the formation of nonmetallic inclusions and decreasing the gas content. However, the cost has been high and the tonnage output limited.

A degassing process that is claimed to achieve a major step in the direction of excellent quality at a very modest increase in cost over air-melted steels has been installed by the Crucible Steel Company of America, Pittsburgh, Pa. It was built by the Lectromelt Division of McGraw-Edison Company of Pittsburgh, Pa., under license of Dortmund-Horder Huttenunion of Dortmund, West Germany.

In the D-H process, a teeming ladle containing 170 tons of untreated molten steel that has been jet-tapped from an open-hearth furnace serves as part of the treating equipment. A pear-shaped treatment vessel forms the other part. This terminates in a protruding refractory suction nozzle which penetrates the liquid metal in the ladle when the treatment vessel is lowered over it. Thus a liquid seal is formed about the nozzle.

The refractory lining of the treatment vessel is electrically heated to 2700 F with the aid of a 600-kva transformer. The vessel is raised and lowered by a 1000-psi hydraulic system powered by three constant-speed 75-hp motors.

High-pressure steam, released through a five-stage ejector system, exerts an abstractive force which gradually pulls the atmosphere to 1/1000 normal pressure from the tightly sealed vessel chamber. The resulting unbalance in pressure causes the liquid steel to be pushed through the suction nozzle and into the refractory-lined vacuum chamber. It rises to a height of approximately 59 in. from the metal line.

Upper and lower limits are then set and the vessel movement is confined within this established range.

Since the system is analogous to a mercury-column barometer, with the weight of the supported column of metal remaining in balance with the force of normal air pressure, the column height does not change as the treatment vessel is moved up and down.

By a calculated adjustment of vessel speed, stroke, and dwell metal is caused to flow up through the nozzle to occupy the expanded area where the vacuum vessel widens out. It remains there long enough for treatment.

Approximately $^1/_{10}$ of the total weight of the metal in the ladle is treated and recirculated with each cycle. For an effective treatment, 32 cycles subject each unit of metal to the vacuum conditions three times.

Specified composition of the treated steel can be attained by releasing a predetermined amount of alloying elements from vacuum-tight addition hoppers at a speed dictated by the solution rate of the alloy.

The final phase of treatment consists of six mixing cycles to promote good homogeneity.

At the end of the treatment the metal is of the desired composition and teeming temperature for casting into 28 individual 12-ton ingots.

## Desalination

A PILOT PLANT to convert sea water to fresh water by precooling, freezing, washing, and melting will be built near Oxnard, Calif., and operated by Rocketdyne Division of North American Aviation, Inc. To go on stream this fall, it will produce from 15,000 to 20,000 gpd of fresh water.

More than $1 million will be spent over the next two years on further research and development of the process which is based on concepts originated some years ago by Ludwig Rosenstein and Manuel Gorin, chemical consultants, of San Francisco. Conventional heat exchangers are eliminated in all major sections.

In precooling, the sea-water temperature is lowered to near freezing by passing a hydrocarbon liquid compound such as octane directly through it, the octane as a liquid having been previously cooled by various process streams.

A more volatile hydrocarbon compound such as butane is used in the second step to freeze the water. The butane also enters as a liquid and absorbs heat to become a gas. In this step ice crystals of fresh water are formed.

The crystals are coated with brine, which is washed off in the third step.

The ice crystals then are melted into fresh water in the fourth step by direct contact with compressed butane.

The system is self-contained and the hydrocarbon compounds are recycled continously so that no hydrocarbons are carried out with the product water.

The fresh cold water produced and other process streams are used to cool the hydrocarbon compounds before they enter the tanks of sea water.

The cost of converting sea water by this process, as calculated under the Office of Saline Water's standardized cost-estimating procedure, is estimated to be lower than that for other currently known processes.

## "Clam-Shell" Arc-Imaging Furnace

RUBIES, sapphires, and silicon-carbide crystals needed for advanced electronic devices will be grown in a new, multipurpose, high-intensity, arc-imaging furnace recently described by Peter E. Glaser, Mem. ASME, of Arthur D. Little, Inc., and George Ploetz, chief of the pyrogenic section of the Air Force-Cambridge Research Laboratory in Bedford, Mass.

The unit, developed by the two organizations, uses two opposing concave mirrors to capture radiant energy from an electric arc and focus it into an area $1/2$ in. in diam to create temperatures in excess of 3500 K (6700 F).

Although furnaces using optically concentrated arc radiation, such as the ADL-Strong Arc-Imaging Furnace, have been commercially available since 1957, the design of the "clam-shell" furnace represents a major improvement in efficiency. Shadowing losses are substantially reduced by locating the radiant energy source and the specimen outside the reflecting system. Radiation enters the clam-shell reflecting chamber through a circular opening in the back of one of the mirrors and converges on a specimen outside an opening in the back of the second mirror.

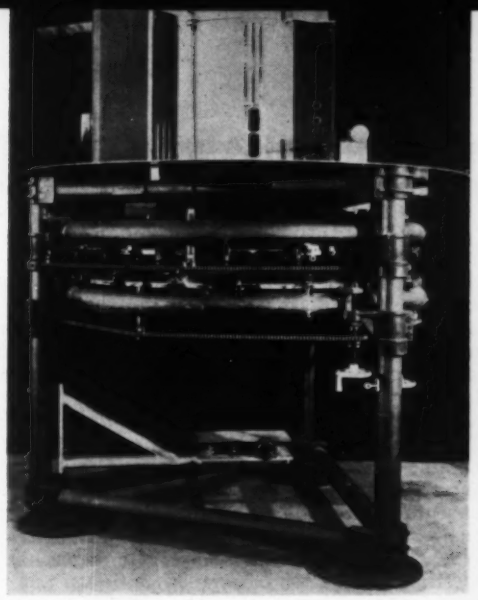
In addition to crystal growing and materials research, the furnaces could be used in refining, in chemical processing, and in welding materials in any desirable atmosphere (or vacuum) free from contamination. Clam-shell furnaces could be used in conjunction with radiant-energy sources other than arcs and their optical systems could be designed to accomplish specific tasks. Radiant energy from these furnaces could be focused onto small areas of large workpieces or the furnaces could be incorporated into machines or production systems requiring intense heat continuously. Two clam-shell systems could also be used jointly to heat workpieces from both sides.

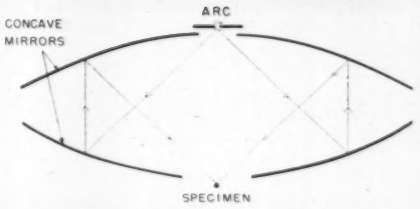
The primary advantage of imaging furnaces is that by optically concentrating radiant energy at a distance away from the burning arc, contamination of specimens is eliminated and better control over temperatures is provided for future industrial uses.

## Combination Auto-Suspension System

A SUSPENSION system which features steel-coil springs in combination with neoprene air-supported cushions for each wheel has been adopted by engineers of Renault, Inc., and patented as the "aerostable" system. The steel coil springs basically provide smooth riding but, as the load or number of passengers is increased, the neoprene air cushions give additional support which prevents bottoming and excessive sway in cornering.

The excellent aging properties, perfect air retention, resistance to oil and salt used on icy roads, high abrasion resistance, and good flexing properties led to the specification of neoprene for this application. It was the only rubber found suitable during the more than four years of developmental work and road testing under a wide range of climates and driving conditions. Not a single instance of cracking or breaking of the neoprene cushions was found during the entire road-testing period. The neoprene cushions are expected to last the car's life.






This arc imaging furnace focuses the radiant energy from an electric arc on area of $1/2$ in. diameter. Temperatures are in excess of 6700 F.

## Multistation Computer

THE G-20, a computer which can be operated by remote consoles 1500 ft away, can store up to 10 times as much information as a conventional system, and can read and write 240,000 digits per sec, is the first model of a new generation of systems to be built by the Bendix Corporation's Computer Division, Los Angeles, Calif.

Low in cost ($850,000), the G-20 is a fast, versatile, and easily expanded system that can be stretched without redesign or extensive coupling to meet expanding needs.

It is a completely transistorized system that can do up to 83,000 additions or substractions per sec.

Low-price in/out stations are also available for the G-20. Several of these remote stations can be used with a single computer.

A control buffer system performs many functions formerly assigned to the machine's central processor and serves to break an operational log jam that limits the performance of many computers.

The G-20 buffer, once ordered into action by the central computer, can proceed under its own control to read punched tape or punched cards, look up data stored on magnetic tape, and print or punch required output.

Meanwhile, the central computer is left free to handle additional computation work.

## Audio-Visual Aids Speed Assembly

ENGINEERS at General Dynamics/Pomona have brought audio-visual aids into a missile plant and speeded the production of complex electronic assemblies by 40 per cent.

The aids combine colored slides with a taped sound track. The operator assembling the equipment observes the slides on an eye-level screen and at the same time listens through earphones to a detailed description of the assembly steps to be followed.

Slides and tape are controlled by the worker to prevent any arbitrary speedup. The worker is allowed to complete each operation at his own working pace, then move on to the next assembly sequence.

General Dynamics engineers picked an electronic instrument for the Tartar missile for a controlled test of the audio-visual devices. This represented an extremely complex assembly problem involving both mechanical and electrical production techniques.

The first step in preparing for the tests was to convert from a line flow where many workers assembled the unit to an operation where one worker built the entire unit. Next, a series of production and assembly photographs were taken and mounted as slides. These were reviewed with the workers who would be using them. Finally, a taped series of instructions was recorded and co-ordinated with the slide projector.

During the two-week test, two workers were placed at the audio-visual station. As a control, two others who had worked on the production line for the same instrument but had never fabricated the complete unit were put through a normal training procedure.

The first units built by both groups required the expected 10 hours of production time. However, by the fourth unit, the audio-visual work stations had reduced the total time required to about six hours. Working time then leveled off to a constant rate. Those building the instrument at the conventional stations showed a small improvement but, even after five or more units had been built, the production time required hovered at between nine and 10 hours.

Operator observes screen while listening through ear phones to detailed description of assembly steps. Test showed aids offer 40 per cent production gain.

Records taken at each station indicated that nonproductive time could be reduced by 5 to 10 per cent through the audio-visual devices since the interest level was higher.

## Services Versus Production

THE greatest change of all in the national economy, according to James M. Nance, president of the Central National Bank, Cleveland, Ohio, is the rise of the "service industries."[1] These now account for the highest percentage of our gross national product, the largest share yet of consumer spending, and the largest employment of American working people.

During the past two years the Federal Department of Labor discovered that production employees in the United States were stabilizing at 26 millions, and had—for the first time—dropped behind the employees in service industries, now totaling 32,500,000.

A prominent reason for this dramatic switch, Mr. Nance continued, is that the consuming public engaged in striving constantly to raise the American standard of living is disposing of more and more of its spendable income on services rather than manufactured goods. He is spending more money on health and medical services; travel, recreation, education, and the other diversities of the "service expenditures" than ever before.

The new character of American participation in the world markets is likely to sharpen this situation. In 1960, again, for the first time in our history, our exports to the world market were more of raw materials and less of end-product goods.

Furthermore, more and more American producers, through overseas and across-border plants, are substituting increasing amounts of foreign labor for the high-cost production labor of our own country, and this will continue at least until labor costs in the rest of the world begin to approach the lofty level of production expense at home.

The other important change is the change in the character of the American worker. Today's employee is very different *psychologically* from former workers.

In the first place, he is better educated and better informed.

A joint study of the Departments of Labor; Commerce; and Health, Education, and Welfare has determined that the average American worker of today has had: (*a*) 16 years' schooling, or equivalent to a college education, if he is a manager; (*b*) 12 years' schooling, if in the sales or supervisory class; (*c*) 11 years' schooling if he is a skilled worker, and that means practically a high-school education; (*d*) 10 years if in the semiskilled jobs; and (*e*) little or no schooling *only* if he is in the unskilled or agricultural job classes.

The fact is, that workers have moved in large numbers from the drudgery and monotony of production jobs to the comparative freedom of movement and work in the service industries. The worker has chosen the relative freedom of driving a dry-cleaning truck on a route of his own, as compared to a daily chore of putting parts on a machine or a motorcar, because he prefers the one to the other out of a sense of motion and self-determination.

[1] Mr. Nance's statement was included in a talk, "Managing Men in the New Economy," at the Annual Executives Night Dinner Meeting of the Cleveland Section of the American Welding Society in January, 1961, which is condensed in part here. He is a former president of Studebaker-Packard Corporation and Hotpoint, Inc.

The manpower forecast for the 1960's is that the decade will produce some substantial changes in the composition of the work force: (*a*) There will be many more young workers; (*b*) those under 25 will total nearly half the work force by 1970, for the age class between 30 and 40 will increase very little; (*c*) despite the earlier retirements trending our way, workers over 45 will steadily increase.

And it is estimated that the increase in employed women will be nearly *twice* as rapid as for male employees, until by 1970 one out of every three employees will be female.

There are now approximately 73,000,000 employees in this country. In 1970 that total is expected to reach 87,000,000—of which 58,000,000 will be persons employed today and 29,000,000 will grow up into jobs in the next 10 years.

If we do not fully know how to command the total productive interests of 73,000,000 employees today, you can see the size of the challenge ahead of us ten years from today. And management—dealing with a larger element of younger persons—will not only have to learn better supervision, expect larger turnover, and install better training on the job, but it must find the key to worker interest over and above the financial incentive and rewards. Practically everyone working for a living wants that good feeling down inside himself that he is capable of achievement—and this factor counts heavily in his own sense of independence.

It is that psychology, the spirit of independence, which all business is being challenged to provide as never before.

It is only in this way that industrial management—no longer the nation's top employers—beset with the needs for finer processes and more technical know-how, can obtain and control the productivity which will be demanded in the decade of the 1960's.

## High-Temperature Burner

BY COMBINING chemical and electrical energy, a new burner supplies heat in the 3000 to 6000-F range for chemical and metallurgical processes. This device has been under development by Arthur D. Little, Inc., for the past two years and is a patented invention of Bela Karlovitz of Combustion and Explosives Research, Inc.

The burner boosts the energy from ordinary combustion of a fuel-oxidant mixture by superimposing electric energy from a low-current, high-voltage, a-c discharge on the flame. Adding electric power equal to one half the chemical combustion power at an optimum air-fuel ratio increases the gas specific enthalpy (heat content) from 1100 Btu per lb to 1600 Btu per lb. Enthalpies of 1900 Btu per lb were obtained with fuel-rich flames, and higher figures are expected from increased electric power.

Any commercially available fuel—natural gas, fuel oil, pulverized coal, or hydrogen—will work in the burner. Oxidizers that can be used range from air or oxygen to fluorine or exotic mixtures. By varying the fuel-oxidizer feed rates the burner is expected to give a reducing, neutral, or oxidizing atmosphere.

The burner is a potential heat source for either rapid, high-temperature heating or an intense localized heat source above 3000 F. It can be especially useful on organic materials since slower heating methods would destroy the molecules and form carbon and various oxides.

Both radiant heating and indirect heating could use the new boosted burner if economical high-temperature refractory materials were available. Other possible uses are fluid bed processes, submerged combustion techniques, reduction of metal oxides, and glass melting.

There is a difference between electrical energy used in the boosted burner and that used in electric arc techniques. While the high-current, low-voltage system of the latter produces a very high temperature in a narrow column of the arc, the low currents and high voltages of the new burner result in a discharge that is uniformly distributed throughout a much larger volume of the flame. Work to date has used an electrical discharge from a 60-cycle a-c power supply at discharge potentials up to 2000 volts and currents to 12 amp.

## Plastic Packaging

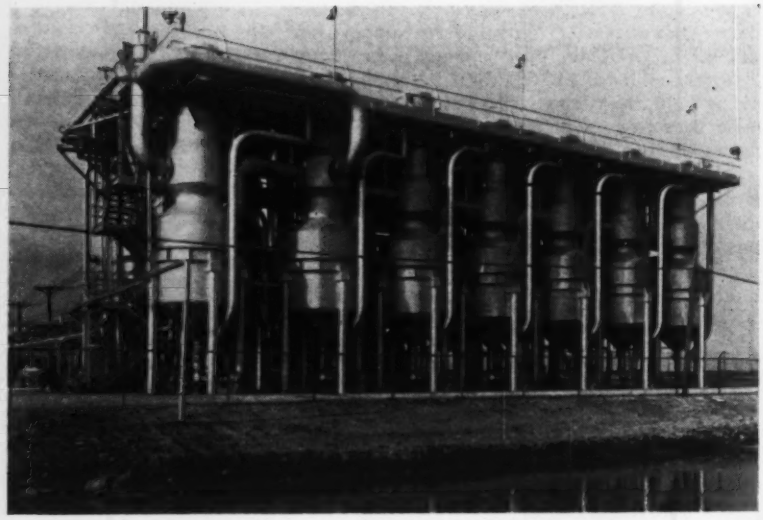
HIGH-DENSITY polyethylene is the basic material used in a new packaging technique developed by the Westinghouse Electric Corporation's meter division in Newark, N. J.

The material is made into plastic caps that conform to the shape of the instrument to be packaged. These caps are snapped on either end of the instrument, then caps and instrument are positioned firmly in a container. Pressure at both ends and on all four sides suspends the instrument within the container.

For commercial use, the instrument will be partially enclosed. However, the instrument can be completely encapsulated when required by military specifications. The material can be sealed to conform with the most rigid specifications involving moisture or vapor barrier packaging protection.

The new plastic caps save both money and space. They can be conveniently nested for storage in a small area and, since they take less room than conventional wrapping, the shipped packages are smaller. Shipping costs are less because of the plastic's light weight. There is also a reduction in labor cost since packaging takes less time.

Plastic caps snap on ends of meter for faster and safer packing. Caps cost less than other packaging materials and can be stacked easily to conserve storage space.



This plant produces fresh water from salt water at a rate of 1,000,000 gal a day. The Office of Saline Water had this plant built as part of its program to supplement the nation's water supply. The conversion process uses long tube vertical multiple effect distillation.

## Seawater Plant in Operation

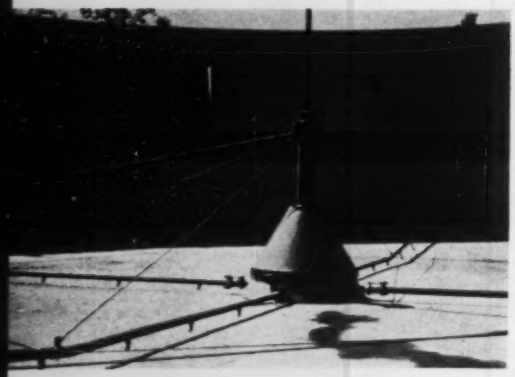
THE economical conversion of salt water to fresh water is now one step closer. The federal government's first experimental conversion plant has successfully completed its design production test and is now in operation.

Chicago Bridge & Iron Company is prime contractor for the plant.

Heart of the demonstration plant is a multistage falling film evaporator system, the first ever to employ 12 effects. As sea water moves through its vertical vessels, a portion of the salty liquid is converted to fresh water and the balance is returned to the Gulf of Mexico. The plant's conversion process, called long tube vertical (LTV) multiple effect distillation, evolved from study and research programs sponsored by the Office of Saline Water under contracts with private industry. (For a complete description of other water-conversion methods, see "Fresh Water From Salt Water" in the October, 1960, issue of MECHANICAL ENGINEERING.)

Design of the experimental system allows the testing of materials to combat anticipated corrosion and scaling within the unit. Eventual control of these two problems will be the key to low-cost production of drinking water from the sea.

Fresh water from the pioneering plant is serving residents of Freeport and two nearby Dow Chemical Company plants. The conversion plant is designed to deliver 1,000,000 gal of fresh water daily at a cost of less than $1 per thousand gallons. But, more important, it is providing valuable data for the design of future and larger installations.



The agitator of this precipitator is powered by water jets instead of the usual electric motors. This sludge-blanket water clarifier can be used for pretreatment of water in city, industrial, and public utliity plants.

## Water-Jet-Powered Precipitator

ELECTRIC motors are eliminated in the new solids-contact type water clarifier from The Permutit Company. By ejecting water from the tips of the agitator the jet effect provides enough force to keep the agitator moving. Without any motors it was unnecessary to build in the usual catwalks and bracing required for support and access to the motor. No overhead support is required for the agitator which rotates on a stub spindle.

In operation, raw water and chemicals are premixed and introduced into the precipitator through an inlet at the center of the tank beneath the agitator hub. A conical deflector on the hub directs the water-chemical mixture outward across the tank bottom. On reaching the tank wall the fluid mixture tends to rise but is redirected back to the center by a horizontal baffle on the tank wall. In this manner a rolling pattern is established, keeping water, chemicals, and sludge in intimate mixture for maximum precipitation. Sludge and heavy particles settle to the bottom, and clarified water is drawn off the top of the tank.

General areas of application of the new equipment, designated the "type M Precipitator," are in pretreatment of water for municipal, industrial, and public utility plants. It may be installed in existing round basins as well as new tanks.

This precipitator can give a good quality of effluent within a short time after the tank has filled. Sudden variations in demand from the plant have little or no effect on the quality of effluent water. At high ranges, a precipitator accommodates easily to sudden flow changes up to 35 per cent. At lower rates the same unit can take flow changes of 80 to 100 per cent.

Permutit plans to build these units with flow rates ranging from 150 to 7000 gpm, diameters from 10 to 100 ft, and depths from 12 to 16 ft.

## Near-Absolute-Zero Refrigerator

A CONTINUOUSLY operating He-3 refrigerator, capable of maintaining temperatures as low as 0.26 K (0 on the Kelvin scale is absolute zero) has been developed by E. Ambler and R. B. Dove, of the National Bureau of Standards. It will be used for a variety of experiments, including magnetic and thermal measurements on paramagnetic substances, and nuclear-orientation studies. The apparatus extends the region of convenient and continuous refrigeration into the range previously accessible only by using the process of magnetic cooling. Heat inputs of up to 2 mw can be handled. Although the refrigerator is not the first of its general type, it is particularly efficient and effective and possesses many novel features which permit simple construction and operation.

A mercury ejector pump, without a mechanical backing pump, is used to recirculate and conserve the He-3 which is rare and expensive.

Details of the refrigerator are given in the June, 1961, *Review of Scientific Instruments*.

## Computers Aid Researchers

THE problem of effective retrieval of scientific and technological information has increased in importance and in difficulty in recent years. Conventional methods of indexing, filing, and searching are not capable of handling the increasing volume of published technical information. The following items are two of the more recent developments in using the computer as a prime tool in this work of making necessary information available to the researcher.

**Computer Indexes Documents.** An electronic digital computer indexes scientific documents according to important words in their titles at Bell Telephone Laboratories. The titles are fed to an IBM 7090 computer on punched cards, along with other cards containing the names of authors and identification numbers. The computer scans these cards, reorganizes the information, and prints out a "Permuted Title" subject index.

The index is called "Permuted" because each significant word of a title appears, in turn, as a "key" word in the index. The word is listed alphabetically at the index position in context with the other words of the title.

The computer ignores unimportant words which have little value as index words. In this case, "application," "of," "the," "in," and "theory" are nonsignificant for indexing purposes. (A table of nonsignificant words is stored in the computer's memory and can be easily changed.)

The computer stores each permuted title in its memory. When all the titles have been permuted, it reshuffles them and produces, on magnetic tape, an index listing the titles alphabetically according to the key word. A high-speed printer takes this tape and prints out the titles in English at a speed of 600 lines per min.

The pages from the high-speed printer can be reproduced by photo-offset and bound into an index book without retyping or typesetting the information.

Also, the output tape can be saved and later "merged" with subsequent tapes to produce a cumulative index. Up to eight tapes can be merged onto one tape; thus monthly indexes can be easily cumulated into semiannual and annual indexes.

In addition to the Permuted Title Index, the computer can produce an alphabetical author index, a bibliographical list of all the indexed documents, and other indexes according to date, language, project, or other classification.

This type of subject index is particularly useful in locating a document when only one clue such as author, number, or one title word is known. The appearance of the complete title in the index helps in deciding whether the document is the one searched for.

**Computer Searches Literature.** Western Reserve University, School of Library Sciences, has installed a General Electric 225 general-purpose computer which has special programming features for conducting literature searches. A researcher asks the computer a question and in a few minutes it will produce a stack of references to all material published on the subject within the last two weeks or past year, depending on the need.

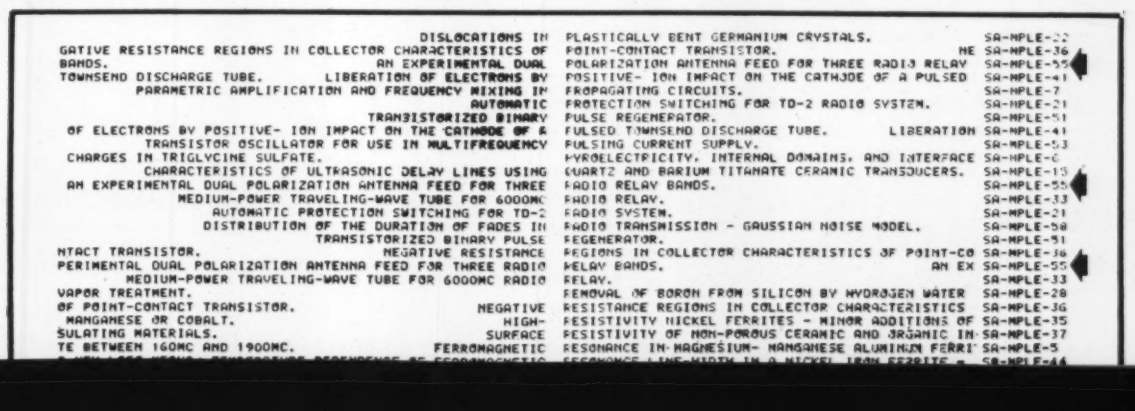
The American Society of Metals, the chief outside sponsor for this project, has spent $150,000 on the development of this system. At the present rate, 36,000 documents on metals and related subjects a year are being transcribed, then encoded into computer "language" on magnetic tape to become part of the machine library.

With so much information readily available, the computer has the advantage of reducing the chance of duplication of research and lessening the time taken for investigation. With this mechanized searching system, information an any aspect of metals or closely related subjects can be on the desks of American industry within two or three weeks after publication as compared to months or years involved in the traditional methods of search. For a subscription fee of $50 per month an engineer, scientist, or researcher can be kept up to date in his field of interest. At present there are 157 subscribers.

The GE 225 can search through encoded digests of technical articles at a rate of nearly 100,000 per hr, taking about 35 minutes to go through some 55,000 documents now stored on magnetic tape.

The computer's magnetic core storage memory has an 8192-word capacity. Other components include dual magnetic tape handler and tape controller, high-speed punched-card input, and electric typewriter output.

This is a section from a "Permuted Title Index" produced by a computer at Bell Laboratories. The computer was programmed to organize and list document titles according to important words in the titles. Each title appears in the index in as many places as it has significant words. Each significant word appears, in turn, at the index position (the column down the center of the page). The arrows indicate where the title, "An Experimental Dual Polarization Antenna Feed for Three Radio Relay Bands," appears under its three key words.



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                                    DISLOCATIONS IN      PLASTICALLY BENT GERMANIUM CRYSTALS.                    SA-MPLE-22
GATIVE RESISTANCE REGIONS IN COLLECTOR CHARACTERISTICS OF  POINT-CONTACT TRANSISTOR.                  NE  SA-MPLE-36
BANDS.                                AN EXPERIMENTAL DUAL  POLARIZATION ANTENNA FEED FOR THREE RADIO RELAY  SA-MPLE-55
TOWNSEND DISCHARGE TUBE.        LIBERATION OF ELECTRONS BY  POSITIVE- ION IMPACT ON THE CATHODE OF A PULSED  SA-MPLE-41
          PARAMETRIC AMPLIFICATION AND FREQUENCY MIXING IN  PROPAGATING CIRCUITS.                             SA-MPLE-7
                                          AUTOMATIC         PROTECTION SWITCHING FOR TD-2 RADIO SYSTEM.       SA-MPLE-21
                                TRANSISTORIZED BINARY       PULSE REGENERATOR.                                SA-MPLE-51
 OF ELECTRONS BY POSITIVE- ION IMPACT ON THE CATHODE OF A   PULSED TOWNSEND DISCHARGE TUBE.        LIBERATION SA-MPLE-41
          TRANSISTOR OSCILLATOR FOR USE IN MULTIFREQUENCY   PULSING CURRENT SUPPLY.                           SA-MPLE-53
 CHARGES IN TRIGLYCINE SULFATE.                             PYROELECTRICITY, INTERNAL DOMAINS, AND INTERFACE  SA-MPLE-6
          CHARACTERISTICS OF ULTRASONIC DELAY LINES USING   QUARTZ AND BARIUM TITANATE CERAMIC TRANSDUCERS.    SA-MPLE-15
 AN EXPERIMENTAL DUAL POLARIZATION ANTENNA FEED FOR THREE   RADIO RELAY BANDS.                                SA-MPLE-55
                MEDIUM-POWER TRAVELING-WAVE TUBE FOR 6000MC RADIO RELAY.                                     SA-MPLE-33
                    AUTOMATIC PROTECTION SWITCHING FOR TD-2 RADIO SYSTEM.                                    SA-MPLE-21
                DISTRIBUTION OF THE DURATION OF FADES IN    RADIO TRANSMISSION - GAUSSIAN NOISE MODEL.        SA-MPLE-58
                                TRANSISTORIZED BINARY PULSE REGENERATOR.                                     SA-MPLE-51
NTACT TRANSISTOR.                       NEGATIVE RESISTANCE REGIONS IN COLLECTOR CHARACTERISTICS OF POINT-CO  SA-MPLE-36
PERIMENTAL DUAL POLARIZATION ANTENNA FEED FOR THREE RADIO  RELAY BANDS.                          AN EX  SA-MPLE-55
          MEDIUM-POWER TRAVELING-WAVE TUBE FOR 6000MC RADIO RELAY.                                       SA-MPLE-33
VAPOR TREATMENT.                                            REMOVAL OF BORON FROM SILICON BY HYDROGEN WATER   SA-MPLE-28
OF POINT-CONTACT TRANSISTOR.                    NEGATIVE    RESISTANCE REGIONS IN COLLECTOR CHARACTERISTICS   SA-MPLE-36
 MANGANESE OR COBALT.                                HIGH-  RESISTIVITY NICKEL FERRITES - MINOR ADDITIONS OF  SA-MPLE-35
SULATING MATERIALS.                                SURFACE  RESISTIVITY OF NON-POROUS CERAMIC AND ORGANIC IN  SA-MPLE-37
TE BETWEEN 1600MC AND 1900MC.                FERROMAGNETIC  RESONANCE IN MAGNESIUM- MANGANESE ALUMINUM FERRI  SA-MPLE-5
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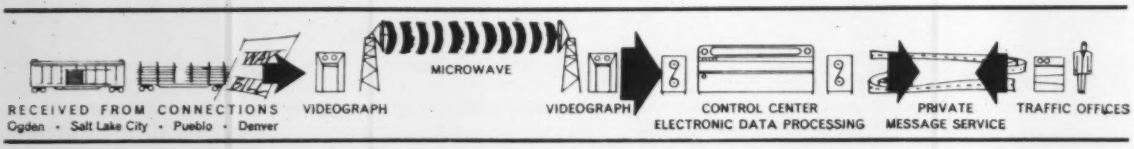



## Railroad Communications System

THE DENVER AND RIO GRANDE WESTERN RAILROAD has recently completed an information processing and communications system called "Shipper Facts." Through these new facilities the Rio Grande can locate and transmit information on any freight-car movement on their system in less than a minute.

The system is the end result of four years of work and an investment of $\$1^1/_2$ million. Aside from the speed of the system, it lifts the burden of paper work and accounting that has reached staggering proportions in the railroad industry.

Five U. S. corporations combined their efforts to produce the necessary components which include a microwave network, facsimile sending and receiving equipment, a large-scale electronic computer, and a new nationwide system of teletype communications.

A. B. Dick Company developed the facsimile transmission and reproduction equipment for the system, working in conjunction with scientists and engineers of the railroad and Stanford Research Institute. The new facsimile equipment was linked to a 700-mile microwave network erected by Motorola, enabling the Rio Grande to centralize control of the entire intermountain railway system at a new data-processing center at their Denver headquarters. A Burroughs 220 computer, modified for the application, was installed to process information received at the center.

The "Videograph," as the facsimile equipment is called, can transmit any document over microwave and reproduce an exact copy at one or all of the railroad's six facsimile sending-receiving points in Colorado and Utah. Transmission time of a letter-size document is 6 sec. Thousands of waybills, which contain all essential information on each shipment, are transmitted daily along with information on each train movement to the Denver headquarters via the microwave net.

At headquarters, information is converted to punched cards, fed to the computer, and sorted on magnetic tape for subsequent processing and to answer customer inquiries. For example, the status of a given freight car can be recalled from the computer in 15 to 50 sec.

In another operation, information contained on the punched cards is converted to punched paper tape, then transmitted automatically over Western Union leased lines to 28 "off-line" Traffic Agencies throughout the U. S. to keep traffic agents, shippers, and receivers fully informed on the progress of various shipments.

Information stored in the computer is also used to perform the railroad's complex "car service accounting." This includes computation of per diem payments to other railroads for their cars while they are on the Rio Grande system as well as rental due from other carriers for Rio Grande cars on their lines.

In still other applications, the electronic system will be used to maintain a carload inventory of principal terminals. At any time a report of cars on hand in any terminal, including the commodity, tonnage, and destination of each, can be printed out at a rate of 150 cars per min.

## Stainless-Steel Hopper Car

A STAINLESS-STEEL-COVERED hopper car will soon go into service on the nation's railroads. The car's cover, hopper, and all interior parts that come in direct contact with the lading have been fabricated from a recently developed stainless steel called USS Tenelon. This steel has almost twice the strength of conventional austenitic stainless steels. It was therefore possible to use light gage sheets of Tenelon, making the car about 16 per cent lighter than conventional hopper cars. Standing empty, the new car weighs 58,500 lb as compared to about 70,000 lb for a conventional car.

Because the new car is corrosion resistant, it can carry many bulk materials without using costly protective linings. There are no areas where particles of one shipment can lodge to contaminate a subsequent shipment of some other material. A thorough washing between shipments makes the interior safe for the next load.

Those parts that don't come in contact with the lading, chiefly structural components, are made from two other steels, USS Cor-Ten and USS Tri-Ten.

Aside from the new steel featured in the car's construction, there is no other special equipment. Both the braking system and the roller bearings are of standard design.

The car was built for U. S. Steel by Pullman-Standard and will undergo its first tests on the Southern Railroad.

U. S. Steel Corp.'s new Tenelon stainless-steel-covered hopper car weighs about 11,000 lb less than a conventional car. This car is corrosion resistant so it can carry many bulk materials without protective linings.

## Nuclear Briefs

### ▶ India Appropriates £38.25 Million for Tarapur

Under the Third-Five-Year Plan, India has appropriated £38.25 million (about $107 million) for the Tarapur nuclear power project. According to the May, 1961, issue of the British journal *Nuclear Engineering*, other appropriations include £1.875 million for the irradiated-fuel processing plant under construction at Trombay and £6.75 million on developing the Jaduganda uranium mines.

### ▶ Nuclear Design Section Added to AEC Journal

A new Design and Construction Practice section has been added to the quarterly journal of *Power Reactor Technology*, prepared for the U. S. Atomic Energy Commission by General Nuclear Engineering Corporation.

An introductory paragraph states that "as more and more nuclear power plants are built, the subjects relating to nuclear-power-plant design and construction practice, with emphasis on how things are actually done in the building of a nuclear power plant rather than on the development or theory underlying the practices, will increase in importance." The new section will appear "whenever suitable material is available for review."

The section first appeared in the March, 1961, issue and is devoted to "Nuclear Pressure Vessels: Codes and Practice." The historic reasons for the establishment of the ASME Boiler and Pressure Vessel Code, and the mechanics of revision are briefly stated.

There is considerable detail on the application of the ASME Code to nuclear-pressure-vessel design and a summary of "the most important restrictions imposed by the nuclear cases."

There is other non-Code material on the effects of transient loadings and fast-neutron irradiation, materials, ASTM standards, inspection methods, and stress relieving.

### ▶ Second Nuclear Frigate

Early in June the House and Senate Armed Services Committees authorized another new nuclear-powered frigate for the U.S. Navy. This ship will cost about $130 million, have a displacement of around 8000 tons, and be powered by two pressurized water reactors. The first ship of this class, the *Bainbridge*, is scheduled for sea trials next year.

### ▶ Civilian Reactor Costs

The eighth successive quarterly survey of costs for civilian nuclear reactor projects has been released by the Atomic Energy Commission. These include reactor projects currently under active design or construction for installation in the U. S.

Costs of $60.6 million were incurred during the three months ended March 31, 1961. Of the total, $52.1 million represented costs for electrical power prototypes and experiments. The remaining $8.5 million was for research and test reactors and the *NS Savannah* nuclear-reactor propulsion plant.

The $52.1 million figure breaks down to $25.6 million to public and private utilities and $26.5 million to the Commission.

## Materials Briefs

### ▶ Superconductor

Under a research contract with the AEC, Atomics International has developed a new superconductor material which offers no resistance to appreciable quantities of electrical current.

The new material is a cold-worked alloy made of about three parts of niobium to one part of zirconium. The alloy is malleable and strong and can be made into wires, bars, strips, and other shapes without losing its superconducting properties. Its development makes possible superconducting magnets to replace conventional bulky and relatively inefficient iron-core electromagnets. Such magnets would have no iron core and would produce magnetic fields many times higher than conventional electromagnets.

Potential uses might be as high-energy particle accelerators or in space technology where the lightweight magnets could store more energy in less space than conventional electrical capacitors.

### ▶ Zircaloy-2 Producd by Powder Metallurgy

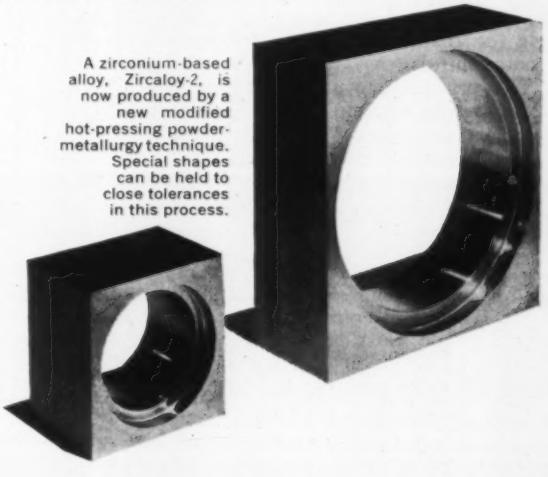
Zircaloy-2, produced by a unique powder-metallurgy process, is commercially available from the Metallurgical Products Department, Detroit, Mich., of General Electric. A modified hot-pressing technique is used to produce finished or semifinished shapes requiring only light machining. The process can also be used for such refractory metals as columbium and tantalum.

Even special shapes can be held to close tolerances to eliminate the cost of machining and the loss of valuable material. For extruded tubing, a hole can be formed directly in a Zircaloy-2 billet without drilling or piercing.

Zircaloy-2, a zirconium-base alloy, offers the nuclear industry low neutron cross section, good mechanical strength, heat resistance, and excellent corrosion resistance to high-temperature steam.

For chemical applications at room temperature it resists attack by most organic acids, all concentrations of nitric, some concentrations of sulfuric, and in general hydrochloric and other chlorides. Alkaline-solution attack is resisted and it also has a high resistance to violently corrosive materials.

Outstanding physical characteristics are those normally associated with a wrought product. For instance, the density is 6.57 grams per cc, which is 100 per cent of theoretical. There is freedom from porosity and properties are nondirectional.



A zirconium-based alloy, Zircaloy-2, is now produced by a new modified hot-pressing powder-metallurgy technique. Special shapes can be held to close tolerances in this process.

Hydra-Point numerical control system is based on pneumatic-hydraulic principles. It is easier to operate and costs 10% less than its electronic counterparts.

## Pneumatic-Hydraulic Tool Control

HYDRA-POINT, a tape-reading numerical-control system for machine tools based upon pneumatic-hydraulic principles, is "immediately available to industry" from the Industrial Division of Moog Servocontrols, Inc., East Aurora, N. Y.

A pneumatic block tape-reader is used to read coordinate and auxiliary instructions from a standard 1-in., 8-channel punched tape. Signal air pressures from the reader are amplified hydraulically and used to position two sets of decoder switch plates on each actuator.

One set of plates selects one of a number of holes spaced at 0.1-in. intervals along the axis of the actuators. The selected hole acts as a valve port in a hydraulic 3-way-valve-controlled servomechanism.

The other set of plates selects one of a hundred holes equally distributed along the circumference of a rotary actuator.

The rotary actuator establishes the angular position of the helical valve land of the hydraulic servo, thereby achieving a minimum position increment of 0.001 in.

It has already been applied to the Burgmaster turret drilling, tapping, and boring machine and the Bridgeport drilling machine. The machine tool and Hydra-Point "package" is claimed to cost approximately 10 per cent less than most comparable installations with electronic controls.

The principle advantages claimed for the Hydra-Point system are simplicity of design and maintenance, speed of operation, and low cost.

The pneumatic-hydraulic system is much easier to operate than its electronic counterparts and needs little or no maintenance. It positions the table at speeds of 350 to 700 ipm and it achieves positioning accuracy of ± 0.0005 in.

The system provides point-to-point positioning for drilling and tapping and for straight-line milling operations. The Hydra-Point system can be applied on new machines or on existing drilling, tapping, and boring machines. Available tap-preparation equipment such as the Flexowriter may be used in programming.

## Speech Is Synthesized

A METHOD of producing synthetic speech with an electronic digital computer, in reponse to the typing of phonetic symbols on a keyboard, has been devised by Bell Telephone Laboratories.

In demonstration of the practicality of a proposed "speaking machine" of the tandem resonant type in which novel principles are to be used, simulation was made with a high-speed, general-purpose computer.

The computer was programmed to accept in sequence, on punched cards, the names of the phonetic speech sounds which make up an English sentence. The computer then processed this information the way an actual speaking machine would, and produced an output like the output of the speaking machine.

The program has two parts. One simulates the speaking machine; the other consists of rules, derived from previous research, for combining the individual speech sounds into connected speech and producing control signals for driving the speaking machine.

Nine control signals corresponding to voice pitch, buzz intensity, hiss intensity, plus the center frequencies and bandwidths of three speech formants are continuously generated.

The speech of the simulated talking machine comes out of the computer on digital magnetic tape. It is then converted to a variable magnetic sound track suitable for playing on an ordinary tape recorder.

Tape recordings were made of the computer "saying" simple sentences in a measured monotone voice. Then more natural inflection and phrasing were demonstrated, by specifying on each punched card, the changes in pitch and timing.

The experiments represented the beginning of a research project to obtain a better understanding of the nature of speech. Ultimately this knowledge may be useful in devising new ways of transmitting speech efficiently over communications systems.

It may also be possible in the near future for a handicapped person to sit at a keyboard and, by typing, cause a talking machine thousands of miles away to speak for him; or a blind person may be able to have a speaking machine read to him from books which have been previously encoded on a punched tape.

Computer processes punched cards containing speech sounds and produces synthesized speech in digital form on magnetic tape. This tape is converted into $^1/_4$-in. tape suitable for an ordinary tape recorder.

Oxygen is blown into molten chrome to produce stainless and other alloy steels. Injection of oxygen raises the temperature of the chrome to quickly reduce silicon and oxygen content.

## Oxygen-Blown Chrome Refining

INTRODUCTION of oxygen blowing into the refining of chrome is now enabling producers of stainless and other alloy steels to make significant improvements in their melting. Announced by Union Carbide Metals Company, division of Union Carbide Corporation, the oxygen-refining innovation produces a better refined charge chrome through the oxygen treatment of molten ferrochrome.

The refined chrome itself is a critical ingredient in the production of stainless steels, tool steels, steel castings, and cast iron. Because of its high degree of cleanliness and low residual content of undesirable elements, the alloy is especially suited for high-quality aircraft and bearing steel.

Carbon and silicon content are reduced quickly through oxidation in the process. The oxygen injection agitates the molten-charge chrome at elevated temperatures and this, in turn, serves to homogenize the refined product, giving maximum chemical uniformity. The oxygen blow also raises the temperature of the molten chrome tapped from the submerged-arc furnace and allows more time for impurities to be removed from the treated fluid alloy. In this respect, the company pointed out how the development parallels the experience of steel producers in oxygen-blowing stainless steel.

Deleterious gas is removed from the melt to produce a solid dense product as molten ferrous alloys are blown with oxygen at high temperatures. Undesirable reactive elements, such as titanium, are substantially removed from the alloy as the carbon and silicon are lowered to desired levels in the refined alloy. As a result, the new refining method produces a refined charge chrome containing 58 to 65 per cent chromium, maximum 4.25 per cent carbon, and maximum 1 per cent silicon. The specification for sulfur is maximum 0.03 per cent.

At 21 cents per lb of chromium delivered, UCM expects the chromium charge material to serve as a low-cost source for stainless steels. The product is expected to be of particular interest to stainless producers because its comparatively low carbon and silicon content will allow large additions of chromium to the base charge. Therefore, stainless melters can add more chromium to the base charge without introducing excessive amounts of carbon and silicon which generate heat during oxidation and cause high bath temperatures. A limited carbon content can, as a result, be maintained prior to decarburization of the stainless-steel bath. A low silicon level, standard in this chromium addition agent, allows the alloy steelmaker to cut the lime addition necessary to maintain proper slag basicity in his furnace. Resulting lower slag volume allows faster heat cycle and higher chromium recovery.

## D-C Transmission by 1985?

THE possibility of using d-c transmission of electric energy may be realized within the next quarter of a century according to R. C. Mildner and John J. Grebe, Mem. ASME, of the Dow Chemical Company, Midland, Mich.

In a technical paper presented at the Summer General Meeting of the American Institute of Electrical Engineers they stated that: "It has been estimated that by the end of 1985 the installed generating capacity of this country may be as high as 875 million kw, that is, about five times the present installed capacity. It is therefore certain that there will be continued pressure to strengthen transmission and distributing systems, and to increase the maximum load that can handled by individual cable lines."

The increased powers that have to be handled call for even higher voltages for transmission and distributing. Conventional-design advances are unlikely to be adequate and it would appear that some radically new solutions are essential. "In Europe experience is being gained in the operation of the d-c transmission techniques that have been developed, and it may be that solid rectifiers based on the superpurity silicon, which is coming into ever-increasing production, will make their contributions in this field."

## Coal Research

AN OFFICE OF COAL RESEARCH has been organized in the U. S. Department of the Interior. In announcing its establishment, John M. Kelly, Assistant Secretary of the Interior for Mineral Resources, stated that, assuming as little as 50 per cent recovery, there are approximately $^{3}/_{4}$ trillion tons of coal at our disposal, and half again as much may eventually be available through improved technology. "This is too large a resource, too valuable a national asset, to be allowed to lie fallow."

Some of the problems to be dealt with: (*a*) Those surrounding the use of coal as an industial commodity; (*b*) gasification—with the aim of producing a gas which can be mixed with natural gas for industrial and consumer use; (*c*) the creation of a liquid fuel which could be utilized by oil refiners; (*d*) efficient, inexpensive methods of transporting coal.

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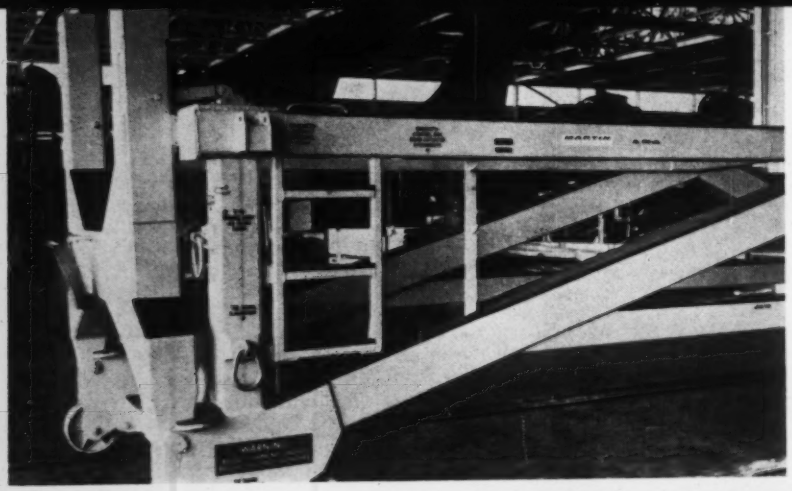
## Correction

On page 73 of our June, 1961, issue, a printer's error placed two pictures with the wrong captions. Pictures in the upper right and lower left of the page should have been interchanged.



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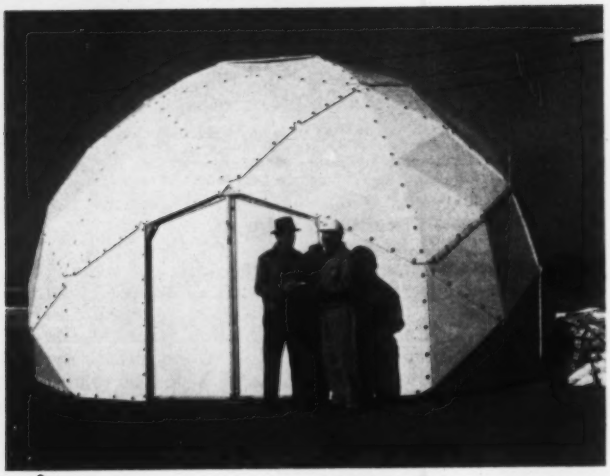

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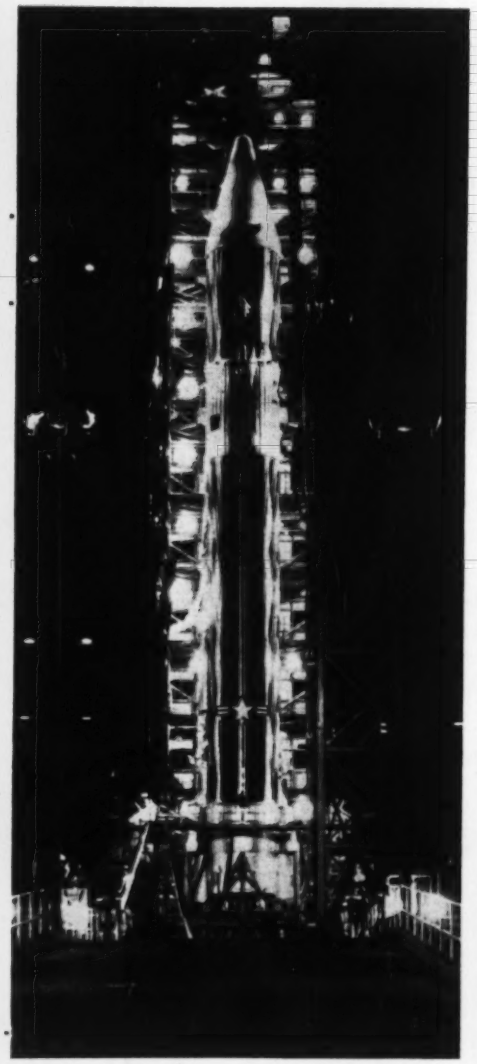
# PHOTO BRIEFS

M. BARRANGON



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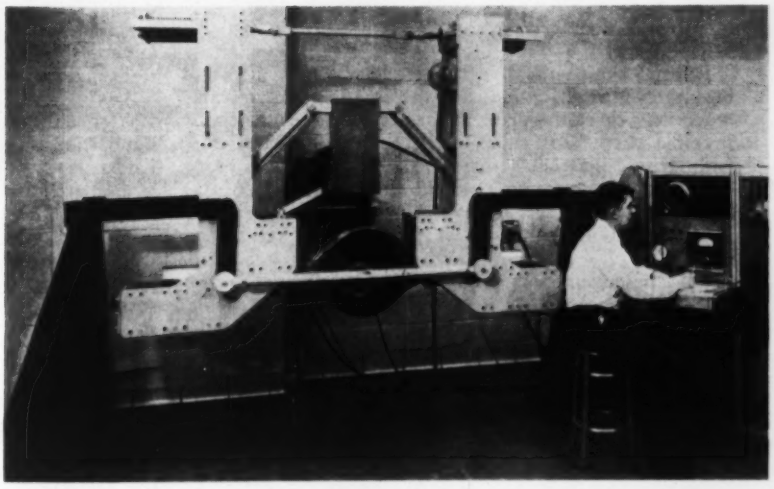
**1 Square Tubing for Economy.** A value-engineering study by The Martin Company, Baltimore, Md., showed that square tubing saved 15 to 20 per cent in labor costs on weld splices for structural assembly on MACE missile launchers. With square instead of round tubing, broad, flat surfaces also permitted easy attachment of brackets for tie-down rings, cables, electrical outlet boxes, and controller housings. Tubing is by Espro Tubing Division, Union Asbestos & Rubber Company, Chicago, Ill. Each tube consists of brake-formed channel sections automatically fused together by submerged arc welding.

**2 Shocktube.** It's a shocktube, not a weapon. A five-lb explosive charge detonated at the apex of this 180-ft conical tube can simulate the blastwaves generated by simultaneously firing six of the most destructive blockbusters ever dropped during World War II. The blastwave is amplified 25,000 times. This is a scale model designed to predict performance of a 2000-ft tube for a 1000-lb charge, for radiation-free simulation of nuclear explosions. The man is W. S. Filler, Naval Ordnance Laboratory physicist, who conceived and developed this device.

**3 Portable Shelter.** Geospace Dome Shelters, St. Louis, Mo., makes this portable shelter for use by industry, agriculture, and the military. Its prefabricated panels are of Formecor board, bent and bolted together at the site; the 22-ft-diam shelter, $12\frac{1}{2}$ ft tall, weighs only 450 lb and costs less than a tent of equal size, though sturdier and more durable. It contains 352 sq ft of floor space and is said to be the first such skin-supported design made available commercially. It's marketed by Filtered Rosin Products Company, Baxley, Ga.

**4 Centaur.** This is the 105-ft-tall Atlas-Centaur space booster, erected on a launch pad at Cape Canaveral. It's a modified Atlas intercontinental ballistic missile, topped by a Centaur upper stage of similar stainless-steel construction. Both are produced by General Dynamics/Astronautics. The Centaur stage is expected to be the first space vehicle powered by liquid hydrogen rocket fuel. Test launchings are scheduled for later this year. Interplanetary probes will be out in 1962. Soft landings of instrument packages on the moon are programmed for 1963.

**5 Fatigue Testing.** For fatigue testing of numbers of car and truck axles in a short time, the new Southfield, Mich., Research Center of Eaton Manufacturing Company, Cleveland, Ohio, created this unique machine which can test an axle housing to destruction in one tenth the time of other machines. Emphasis at the Eaton research facility will be on new products, new ideas, and new processes.



5

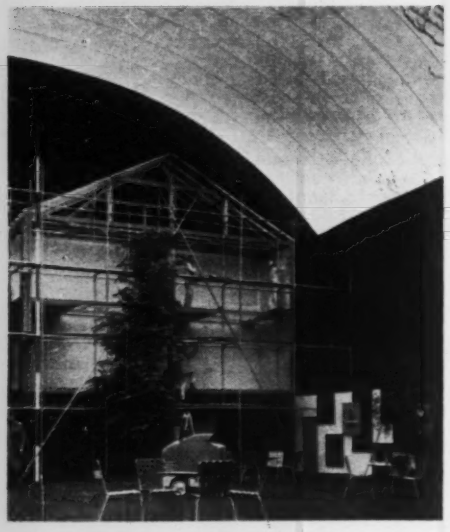
Engineering Progress in the British Isles and Western Europe

J. FOSTER PETREE
European Correspondent

# EUROPEAN SURVEY

Krupp "air pressure hall" exhibited at 1961 German Industries Fair, Hanover

Construction of a three-story house proceeds unhindered by weather inside protective cover of "air pressure hall"



## More Power for Northern Ireland

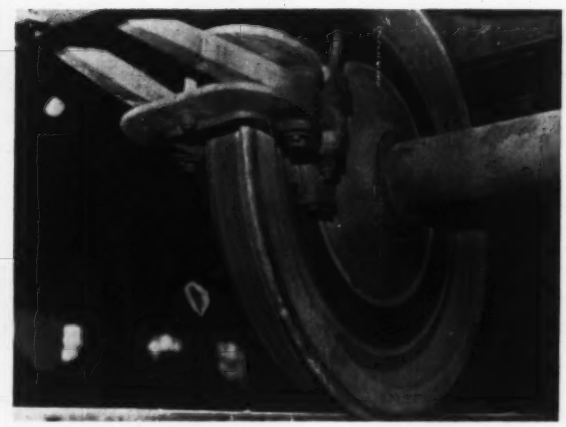
DURING the past few years there has been a considerable diversification of industry in Northern Ireland and much new capital, a great deal of it American, has been invested there. Examples are the du Pont Co. (U.K.) Ltd., whose plastics factory was the first overseas plant of the du Pont interests, and the Chemstrand factory at Coleraine. Then there are several firms of American origin in the neighborhood of Belfast that make oil-well equipment.

All these represent fairly recent additions to the basic industrial power loads of the Harland & Wolff shipyards, the flax mills, and the "fringe trades" of the textile industry. To meet this power demand the Belfast City Corporation have now brought the installed capacity of their West power station to 240 megawatts by the addition of three 60-megawatt sets of Parsons turbo alternators with nine boilers (three by Babcock & Wilcox Ltd., and six by the Mitchell Engineering Co.), each having a continuous maximum output of 220,000 lb per hr of steam at 950 psi and 925 F.

## Building Houses Under Cover

THE severe winter weather of northern Europe has inspired a new use for plastic sheet that enables house building to be carried on in comparative comfort irrespective of climatic conditions. In Sweden the method has been developed by AB Svenska Metallwerken, of Upplands Väsby, in a form that can be used even by a small builder. It consists of making a "balloon" of thin plastic sheet large enough to cover the site and high enough to enclose the completed house, and then keeping it inflated by means of an electrically driven fan. The plastic sheet is supplied in standard widths ranging from 1300 mm (51 in.) to 6000 mm (236 in.). The sheets are joined on site by the use of a 220-volt manual plastic-welder. Reasonable airtightness is maintained by burying the bottom edge in a trench about 12 in. deep, or, if the ground is not too uneven, anchoring it with sandbags. An airlock in the wall provides access, opening inward so that the internal air pressure keeps the flap tight. Small fan and motor are inside the balloon.

An impressive demonstration of the same principle was an exhibit by the German firm of Fried. Krupp Baubetriebe, of Essen, at the 1961 German Industries Fair at Hanover. This "Traglufthalle," as they termed it, had a length of 60 m (197 ft), a breadth of 26.8 m (85 ft), and a height of 13.2 m (43 ft) and contained a volume of 15,000 cu m (53,000 cu ft). Various small trees growing on the site were not disturbed, but were enveloped by the "Halle" along with a section of a three-story house that was built within its protective covering. In this case, the material was nylon, of fairly heavy gage, made by the Vereinigte Glanzstoff Fabriken A.G., Wuppertal-Elberfeld, Germany. As the shape was held more rigidly than in the Swedish example mentioned, by maintaining a somewhat higher internal pressure, more elaborate sealing arrangements were made at ground level. The side walls were provided with a longitudinal flap, turned inward and held down to the ground, and external anchorages were driven into the earth.

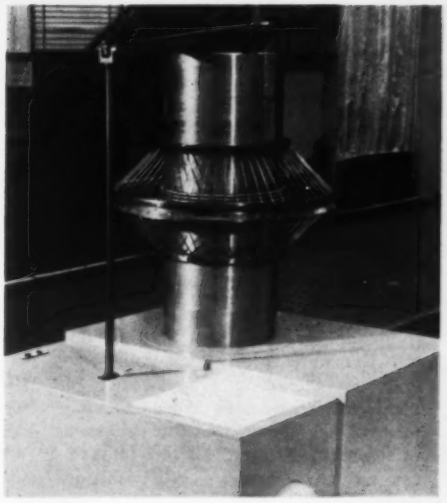


One of disk brakes now in regular service on the British Railways. View of integral rail wheel and brake disk shows application of caliper.

## Railroad Disk Brakes

AFTER several years of research, British Railways are using the first railway vehicles in the world to go into regular service with disk brakes. The system has been developed by J. F. Harrison, chief mechanical engineer on the British Railways Central Staff, in conjunction with the Locomotive, Carriage and Wagon Development Unit at Darlington, England, and Girling Ltd., of Birmingham, England. A special feature is the use of the wheel as the brake disk. Large-scale tests are to be made with 62 21-ton hopper-type coal wagons, 50 16-ton mineral wagons, and 100 24$^1/_2$-ton hopper wagons. The 62 21-ton wagons, made up as three express freight trains, are now running regularly from the Nottingham coalfield to London, and the other vehicles will go into service shortly. The brake is actuated by a 14-in. diaphragm-type vacuum cylinder, rigidly mounted on the underframe. A double-fulcrum linkage transmits the braking force to a caliper bracket carrying two levers that force the brake pads against machined faces on the web of the rail wheel. The selection of one fulcrum or the other is automatic, varying the applied braking pressure according to whether the vehicle is empty or loaded; when it is empty, the effective leverage is 1:1, and when it is loaded, 2$^1/_2$:1. The caliper mounting is supported at its open end by suspension links that take the braking drag force and hold the shoes approximately parallel to the facing on the wheel, while permitting the whole mechanism to float with any axial movement of the wheels. The brake pads, of a nonmetallic composition, can be used until they are worn down to $^1/_4$ in. thick, and their condition can be examined without removing them from the shoes. The new braking gear is particularly suitable for wagons with bottom discharge doors, where central pull rods cannot be used; also, no transverse equalizing beams are required. On hopper wagons two sets of the equipment are being fitted, one for each pair of wheels, but on the mineral wagons one set will brake all four wheels.

Working model of bellows-restraint mechanism on a new type of expansion joint for high-pressure steam. The display provides flexing action for demonstration purposes.



## High-Pressure Expansion Joint

RICHARDSONS, WESTGARTH AND CO., LTD., Wallsend, England, have brought out a new type of expansion joint for high-pressure steam pipes and similar applications.

It is to be used in the Trawsfynydd nuclear power station now under construction in North Wales. The abutting ends of two lengths of the piping are connected by a bellows of conventional design, but with a novel form of restraint that holds the line rigid in an axial direction while permitting considerable transverse deflection. It consists of two conical assemblies of steel tie bars, each bar having one end set in a shoulder formed on the short duct connecting the bellows to the straight pipe, and the other end attached to a floating outer ring with a diameter about twice that of the steam pipe.

There are modifications of this design to suit special cases and to reduce the over-all diameter. A full-size prototype joint for the Trawsfynydd station was subjected to extensive fatigue tests required by the insurers, and passed them successfully.

Correspondence with Mr. Petree should be addressed to 36 Mayfield Road, Sutton, Surrey, England.

Substance in Brief of Papers Presented at ASME Meetings

KAREN SODERQUIST
Editorial Asst.

# ASME TECHNICAL DIGEST

## Maintenance and Plant Engineering

**A Maintenance Improvement and Cost Control Program..61—MPE-10...** By Albert Chapman, Mem. ASME, Ford Motor Company, Dearborn, Mich. 1961 ASME Maintenance and Plant Engineering Conference paper (multilithographed; available to Feb. 1, 1962).

Maintenance operations have an ever-increasing effect on plant productivity and manufacturing costs. It behooves management to take advantage of all techniques available that lead to improved maintenance. A ten-point program for increasing the efficiency of plant maintenance is presented. Experience has shown that the adoption of the various features of this program can result in decreases in production down time and maintenance costs.

The program starts with the establishment of a plant engineering organization capable of applying proper cost controls, scheduled maintenance, and other factors including planning and scheduling, work measurement, methods and standards, nonproduction materials, maintenance budget preparation, training of personnel, and reports to management. Each of these factors is discussed.

**Fuels and Lubricants for Industrial Plant Trucks..61—MPE-2...** By Nevin T. Brenner, Gulf Research and Development Company, Pittsburgh, Pa. 1961 ASME Maintenance and Plant Engineering Conference paper (multilithographed; available to Feb. 1, 1962).

Suggestions are given on various phases of the maintenance of industrial trucks, particularly lubrication and associated subjects, in the hope that this may help to increase operating efficiency, reduce costs, prolong equipment life, and reduce service interruptions. Three fuels commonly used in lift trucks powered by internal-combustion engines—gasoline, LP-gas, and diesel fuel—are discussed, with special reference to LP-gas.

Mention is made of the advantages or disadvantages of various types of trucks, including electric, gasoline-electric, gasoline, LP-gas, or diesel trucks.

**The Role of Lubrication in Preventive Maintenance Engineering..61—MPE-5...** By Ted R. Witt, Mem. ASME, Tennessee Eastman Company, Division of Eastman Kodak Company, Kingsport, Tenn. 1961 ASME Maintenance and Plant Engineering Conference paper (multilithographed; available to Feb. 1, 1962).

An organized preventive maintenance program is required to keep up with new developments and apply them to plant maintenance problems. Preventive maintenance to the author's company means a continual effort to improve equipment reliability, increase efficiency, and reduce repair costs through the use of improved designs, methods, and materials. The company's preventive maintenance organization and the methods used to follow the improvement projects are described. Illustrations of some of the improvements that have been made are given.

**Lubrication Standards. Are They Really Necessary?..61—MPE-4...** By Robert C. Garretson, Westinghouse Electric Corporation, Pittsburgh, Pa. 1961 ASME Maintenance and Plant Engineering Conference paper (multilithographed; available to Feb. 1, 1962).

In 1947 the General Motors Corporation initiated a study to determine what could be done to reduce the excessively high maintenance costs caused by the inaccessibility of hydraulic pumps, valves, and piping. Conferences with other users and manufacturers of hydraulic equipment resulted in the creation of a Joint Industry Conference, which eventually published the JIC Standards for Industrial Hydraulics. By means of such standards the equipment manufacturers have been kept informed of the customers' wants and needs, the end result being greater safety for personnel, increased production, longer equipment life, and reduced maintenance.

The need for similar standards covering the application of lubricants and lubricating devices is discussed and the reasons for many of the requirements of the proposed Westinghouse Lubrication Standards are considered. Illustrations are used to show some examples of design which affect the ease and cost of servicing and repairing industrial equipment.

**A New Tool for Maintenance Cost Control..61—MPE-3...** By E. A. Rachal, Mem. ASME, and W. E. Dougher, E. I. du Pont de Nemours & Company, Aiken, S. C. 1961 ASME Maintenance and Plant Engineering Conference paper (multilithographed; available to Feb. 1, 1962).

Increased mechanization in industrial plants has greatly increased the share of the product cost that is borne by maintenance groups. As a result, the administrative control of maintenance costs has become increasingly important to management. Frequently, people with technical and craft training do not have an affinity for accounting and cost control systems, yet these are the people who must control the cost of work, particularly the labor dollar. This paper describes a new approach to the problem of controlling maintenance costs. The system described has been in effect for two years at a large and complex plant. The authors believe that it has proved efficient and effective.

It utilizes the flexibility of high-speed data-processing equipment and is capable of providing reports for different levels of management in whatever detail is necessary to each level in the following order:

1 The foreman receives each week a detailed report on each work order assigned to him for execution and control, and a report on the work backlog for his individual group.

2 The second-level (or area) super-

viser receives each month a brief listing of all work orders assigned to his various foremen and the total charges to each order, grouped and totaled by the plant facility for which the work was done.

3 The third-level (or division) supervisor receives each month a concise but comprehensive report on expenditures for each facility or process within the division.

These reports and several others are examined in detail.

**The Real Facts About Maintenance Coatings..61—MPE-6...** By William H. McKnight, Union Carbide Plastics Company, Division of Union Carbide Corporation, Bound Brook, N. J. 1961 ASME Maintenance and Plant Engineering Conference paper (multilithographed; available to Feb. 1, 1962).

It is commonly accepted that vinyl-based maintenance coatings provide the best all-around corrosion protection. Until recently, however, it was also commonly accepted that this extra protection entailed a premium price for sandblasting, as well as a generally higher cost for the coating itself.

The relative cost between conventional cheaper-to-apply oleoresinous maintenance systems and the so-called "costly vinyl systems" is discussed. Also mentioned are two new protective-coating systems that eliminate one of the most expensive parts of virtually all industrial maintenance systems, namely, sandblasting. Reviewed are a number of prominent case histories, collected over the years, that point up strongly the long-term advantages of vinyls as industrial protective coatings.

**Maintenance Cost Reduction and Control in a Paper Mill..61—MPE-7...** By Charles V. Clarke, H. B. Maynard and Company, Inc., New York, N. Y. 1961 Maintenance and Plant Engineering Conference paper (multilithographed; available to Feb. 1, 1962).

A leading pulp and paper manufacturing company has about 180 maintenance people in the usual craft breakdown of pipefitting, electrical, carpentry, painting, millwright, machine repair, plus a fairly large machine shop that handles the repair and building of special paper equipment. The company had the usual maintenance problems associated with near continuous process operations.

Members of the management group visited a number of companies to explore firsthand the use of the Universal Maintenance Standards (UMS) technique. What they found out on their visits impressed the group sufficiently so that they recommended to their executive committee the installation of UMS for all their maintenance work.

The installation of the standards on a measured day work basis at the company proceeded extremely well in each of the craft shops. The author describes the procedures that were followed and warns of the possible pitfalls that may be encountered in accomplishing installations of this type.

**Evaluation of the Safety Aspects of Window Glazing Materials in Industry.. 61—MPE-8...** By W. E. Seuberling, Monsanto Chemical Company, Springfield, Mass. 1961 ASME Maintenance and Plant Engineering Conference paper (multilithographed; available to Feb. 1, 1962).

The need for a critical review of window-glazing standards is re-emphasized each time an industrial catastrophe occurs. Many injuries can be traced to flying glass or failure of glazing to perform its function as a protective shield. This paper cites the need for proper glazing, the advantages and disadvantages of available glazing materials, and specific criteria established by the author's company for the glazing and new installations.

The author notes that glazing materials must serve functional considerations, as well as architectural. Where a pressure, projectile, or fire potential is present, glazing should be specified and installed to serve the functional purpose and to minimize personnel injury in the event of mishap. Defining the problems that industry can encounter provides the basis for evaluation of glazing materials.

**Simplified Preventive Maintenance Scheduling Systems..61—MPE-9...** By Kenneth M. Smith, Assoc. Mem. ASME, Caterpillar Tractor Company, Peoria, Ill. 1961 ASME Maintenance and Plant Engineering Conference paper (multilithographed; available to Feb. 1, 1962).

The step-by-step development is shown of effective preventive maintenance scheduling systems that can be developed by existing plant organizations with a minimum of additional clerical costs. The increasing complexity of individual machines and the growing interdependence of many machines upon each other make it more and more necessary to further develop and perform preventive maintenance operations such as lubrication, inspection, cleaning, adjustment, and timely replacement of worn parts in order to keep production interruptions at the smallest practical minimum.

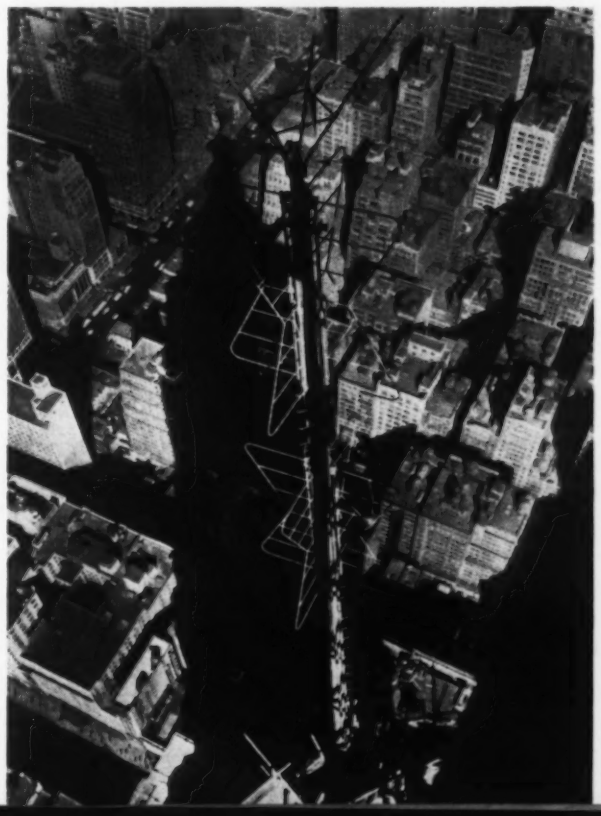
Three types of scheduling systems are discussed:

1 A visual schedule board system designed for small plants or for plant areas under the control of one maintenance superintendent.

2 An addressograph printed-card system for small or large plants.

3 A machine accounting punched-card system suitable for any plant which has suitable machine accounting equip-

In January, 1952, when this 222-ft steel television transmitting tower was erected atop the Empire State Building in New York, it was painted with vinyl-based coatings. Recently inspected, it was found to be in excellent condition, and was estimated not to require repainting until 1965. (61—MPE-6).



ment. This system permits the accumulation and machine tabulation of comprehensive data.

**Reduction of Maintenance Cost With "Teflon" Fluorocarbon Resins..61—MPE-1...** By R. D. Pillsbury, Jr., E. I. du Pont de Nemours & Company, Inc., Wilmington, Del. 1961 ASME Maintenance and Plant Engineering Conference paper (multilithographed; available to Feb. 1, 1962).

"Teflon" fluorocarbon resins offer the maintenance engineer as close to a universal low-up-keep material as chemistry has been able to develop. Because Teflon resins were long classed as too expensive for everyday use, many people tried every other possible material before resorting to these plastics. However, this idea is changing rapidly, for it is being recognized that Teflon resins, applied properly, can result in substantial savings.

Teflon fluorocarbon resins offer industry a combination of properties unmatched by any other engineering material. Usually, the maintenance engineer is best qualified to interpret these material properties in terms of actual dollar savings. This paper describes a number of industrial plant cases where significant improvements have been realized through the use of Teflon resins. Among these cases are the use of Teflon in packings and gaskets, lined pipe, valves, bellows, and other piping components, as well as in hose, piston rings, and nonlubricated bearings.

Wire insulated with a Teflon fluorocarbon resin is unaffected by the hot soldering iron, while ordinary wire melts. TFE resins possess a 900-F temperature span as well as other highly desirable properties, offering a means for reducing costs in a variety of industrial applications (61—MPE-1).

## Lubrication

**A Solution of Reynolds Equation for a Full Finite Journal Bearing..61—LubS-1...** By S. Ramachandra, Indian Institute of Technology, Kharagpur, India. 1961 ASME Lubrication Symposium paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to March 1, 1962).

Reynolds equation for the pressure in a full finite journal bearing which is nonhomogeneous has been reduced to a homogeneous equation. By separating the variables the problem is reduced to an eigenvalue problem. The orthogonal functions expansion method is used to determine the eigenvalues and eigenfunctions. First four eigenvalues are calculated. Design charts are prepared for the eccentricity ratios of 0.2, 0.4, 0.6, 0.8, and length-to-diameter ratios of 0.5, 1.0, 1.5, and 2.0.

**Mechanisms of Boundary Lubrication..61—LubS-5...** By P. R. Lancaster, Institute of Technology, Bradford, England, and G. W. Rowe, University of Birmingham, Edgbaston, Birmingham, England. 1961 ASME Lubrication Symposium paper (multilithographed; available to March 1, 1962).

This paper describes an experimental study of lubrication of copper, mild steel, and stainless steel during slow metal-drawing at room temperature under heavy loads using dies of high entry angle to discourage hydrodynamic contributions. It is found that the relative behavior of different boundary lubricants persists when the loads are increased from common laboratory values of a few kilograms to industrial-scale loads of a few tons, provided the surface is not seriously stretched. It is found that the "coefficient" of friction is not a single-valued constant for a given combination of materials, but depends on the amount of lubricant present in the working interface.

**Rolling-Contact Fatigue Studies With Four Tool Steels and a Crystallized Glass Ceramic..61—LubS-3...** By Erwin V. Zaretsky and William J. Anderson, Lewis Research Center, NASA, Cleveland, Ohio. 1961 ASME Lubrication Symposium paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to March 1, 1962).

The rolling-contact fatigue properties of crystallized glass ceramic balls together with AISI M-1, AISI M-50, Halmo, and WB-49 alloy steel balls tempered to various hardness levels were determined in the NASA spin rig and in the five-ball fatigue tester. A continuous increase in fatigue life and load capacity for each steel was observed with increased ball hardness. These results correlate with resistance to plastic deformation as measured with spherical specimens in rolling contact but do not correlate with elastic limit and yield strength measured for bar specimens. These bar specimens showed optimum values at intermediate hardness levels. Extremely low scatter in fatigue life for the ceramic balls indicate that the degree of structural homogeneity may be an important factor in life scatter of bearing materials.

**Frictional Behavior of Sodium-Lubricated Materials in a Controlled High-Temperature Environment..61—LubS-16...** By J. W. Kissel, W. A. Glaeser, and C. M. Allen, Battelle Memorial Institute, Columbus, Ohio. 1961 ASME Lubrication Symposium paper (multilithographed; available to March 1, 1962).

In a recent study a number of screening-type experiments were performed in which stationary and rubbing specimens were immersed in molten alkali metal in the effort to develop material combinations which would perform well at high temperatures. Later in this same work several materials which were not attacked by high-temperature (1500 F) sodium and which did not weld together during long immersion were found. However, when these materials were used as bearings under various operating conditions assumed for specific reactor components, they did not perform reliably. Consequently, the present study was undertaken to obtain basic information on the friction and wear behavior of selected materials in sodium environments.

The frictional behavior between sliding-contact specimens was studied over a temperature range of 80 to 1300 F. Speed and load were about 0.2 mm per sec and 100,000 psi, respectively. Experiments were performed in argon-swept vacuum, both dry and with molten sodium at the specimen interface. Materials studied include molybdenum, tungsten, tungsten carbide, and titanium carbide. It was found that chemisorbed films were produced on the specimen surfaces, and that the composition of these was largely determined by the type and duration of environmental exposure. The relationship between the observed stick-slip behavior and the presence of surface films of specific compositions is discussed.

**Non-Rotating Journal Bearings Under Sinusoidal Loads..61—LubS-6...** By R. M. Phelan, Mem. ASME; Sibley School of Mechanical Engineering, Cornell University, Ithaca, N. Y. 1961 ASME Lubrication Symposium paper (multilithographed; available to March 1, 1962).

The results of experimental investigations of the operational characteristics of journal bearings when carrying a sinusoidal load with zero angular velocity for both the journal and bearing are presented and compared with predictions of existing theories. Deficiencies of the analytical solutions are noted, particularly with respect to the effects of the assumed extent of the oil film, the ade-

quacy of oil supply, the clearance ratio, and the assumed leakage path.

The elementary model of approaching flat plates is discussed and the Stefan equation is modified by an area factor $k$, which relates equivalent circular plates to the projected area of the actual bearing. The value of $k$ is determined from experimental data and, although the flat-plate model is found to be inadequate, the area-factor concept is shown to permit a reasonable prediction of the behavior for bearings with other than extremely small clearance. A comparison is made of the relative capacities of the squeeze and wedge films, and the possibility of predicting the behavior of a statically loaded ordinary journal bearing when subjected to an additional suddenly applied load is discussed.

**Squeeze Films; A Finite Journal Bearing With a Fluctuating Load..61—LubS-7...** By Donald F. Hays, General Motors Corporation, Warren, Mich. 1961 ASME Lubrication Symposium paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to March 1, 1962).

In order to obtain a solution for the squeeze film effects in lubrication analyses, recourse was made to the assumption of the infinite bearing and the troublesome problem of finiteness was circumvented. Although this assumption simplifies the equation and yields qualitative results, it does not present a true model of the squeeze film phenomenon. Since this phenomenon may contribute greatly to the load characteristics of a bearing, the variational techniques previously reported have been extended to cover the effects of the squeeze film. The purpose of this paper is to present this analytical technique and to apply it toward the solution of a finite journal bearing sustaining a fluctuating load with no journal rotation. The characteristics of a finite journal bearing under a cyclic sinusoidal load are shown in curve form.

**Externally Pressurized Step Journal Bearings..61—LubS-8...** By Clarence R. Adams, Assoc. Mem. ASME, Juraj Dworski, and Edward M. Shoemaker, Assoc. Mem. ASME, Boeing Airplane Company, Seattle, Wash. 1961 ASME Lubrication Symposium paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to March 1, 1962).

An externally pressurized gas journal bearing which achieves its load-carrying capability by utilizing flow throttling dams parallel to the direction of rotation is discussed. Test procedures and equipment used to develop this bearing concept are described. A theoretical method of determining pressure distribution and load-carrying capacity for the bearing is presented and correlated with experimental data for nonrotating shafts. Experiments showing the behavior of the bearing under shaft whirl conditions are described and illustrated. Suggested ranges of the design parameters are indicated. The paper also points out advantages accruing from the design simplicity as well as the static and dynamic stability of this bearing concept.

**Evaluation of Unconventional Lubricants at 1200 F in High-Speed Rolling Contact Bearings..61—LubS-9...** By Donald S. Wilson, Fairchild Engine and Airplane Corporation, Bayshore, L. I., N. Y. 1961 ASME Lubrication Symposium paper (multilithographed; available to March 1, 1962).

The ever-increasing operating speeds of missiles and aircraft introduce greater demands on equipment within these vehicles due to the associated increase in operating temperature parameters resulting from aerodynamic frictional heating, radiant heat, and heat loads generated by additional complex equipment. It is anticipated that future demands will result in operating temperatures beyond the limits of common usage lubricants and bearing materials.

Several powdered lubricant materials were selected for evaluation in 20-mm-bore-diam angular-contact bearings at 1200 F with an ultimate objective of attaining 10 hr of bearing operation at 50,000 rpm under a combined 50-lb radial load and 50-lb thrust load. To permit operation at these temperatures, bearing materials of titanium-carbide cermet and cobalt-base alloys were chosen and a reliable method of feeding a continuous supply of the powdered lubricant entrained in a gaseous carrier to the bearing was developed.

**Low-Temperature Pumpability of Experimental Lubricating Fluids..61—LubS-10...** by L. R. Drane, Graham Air Force Base, Marianna, Fla., and Vernice Hopkins, Midwest Research Institute, Kansas City, Mo. 1961 ASME Lubrication Symposium paper (multilithographed; available to March 1, 1962).

Present-day lubricants and hydraulic fluids for high-performance aircraft are required to operate over increasingly wider ranges of temperature. Extension of the upper temperature limit, which is imperative for operation of these vehicles, causes a severe problem in maintaining low-temperature capabilities of fluids. This paper presents the results of a program conducted to investigate the initial pumpability characteristics of a group of fluids at subzero temperatures.

An investigation was made to determine the initial pumping rates of five esters, one silicone, one silane, and one super-refined mineral oil at temperatures down to −95 F. Most of these lubricating fluids were pumped at temperatures below their pour points. Peak driving torques measured during a simulated cold start were many times that required at rated conditions.

**Journal Bearings With Arbitrary Position of Source—11..61—LubS-2...** By J. V. Fedor, NASA, Goddard Space Flight Center, Greenbelt, Md. 1961 ASME Lubrication Symposium paper (in type; to be published in **Trans. ASME—J. Basic Engng.**; available to March 1, 1962).

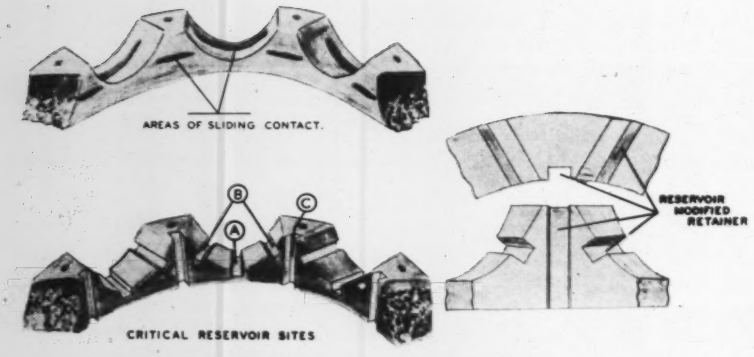
A complete oil solution of Reynolds equation is found that takes into account the presence of a point source. The solution gives integrated journal bearing characteristics in finite form. With the load in a vertical plane and the source at the top or bottom of the bearing, two simple universal relationships have emerged between the angle indicating the line of centers ($\alpha$) and the eccentricity ($b$).

With the source at the base of the bearing and $-\cos \alpha = b$, the plot of coefficient of friction versus the Sommerfeld variable goes through the origin and is essentially independent of bearing length to diameter ratio. Also, lubricant end flow becomes vanishingly small as the Sommerfeld variable approaches zero.

With the source at the top of the bearing a friction axis intercept can be obtained depending upon a source parameter $q$. With $\cos \alpha \approx b/2$, a rapid rise in the coefficient of friction can also be simulated by properly varying the source parameter. Also, lubricant end flow increases monotonically as the Sommerfeld variable approaches zero.

**Phase Plane Analysis of Dynamically Loaded Journal Bearings..61—LubS-12..** By H. T. Albachten, International Business Machines Corporation, San Jose, Calif. 1961 ASME Lubrication Symposium paper (multilithographed; available to March 1, 1962).

The dynamic behavior of a perfectly aligned, infinitely long, massless journal is investigated while it is rotating in a complete bearing under the influence of external load and fluid pressure forces. Harrison's classical nonlinear equations describing this condition are analyzed by phase-plane techniques which result in velocity versus displacement plots of the journal eccentricity. It is found that the journal is normally neutrally stable as exhibited by a center singularity in the phase plane. Guided by the phase-plane analysis, it also seems possible to explain the erratic or unstable journal behavior frequently found in journal bearings operating at high rotational speeds and/or light loadings. It is shown that this instability is also possible at slow speeds and/or heavy




Section of machined bearing retainer has series of rectangular reservoirs perpendicular to forward motion of ball bearing. After applying vapor-blast pretreatment to surfaces, a solid-film lubricant was deposited in the reservoirs. Modification proved to be 400 per cent more effective (61—LubS-11).

loading. Examples of phase-plane portraits are presented and these are correlated with the physical journal motion.

**Friction and Wear Behavior of Refractory Materials at High Sliding Velocities and Temperatures..61—LubS-15**...By L. B. Sibley and C. M. Allen, Battelle Memorial Institute, Columbus, Ohio. 1961 ASME Lubrication Symposium paper (multilithographed; available to March 1, 1962).

Various ceramic and cermet materials have been evaluated for unlubricated wear resistance at high sliding speed (100 to 200 fps) and low unit load (5 to 50 psi) in 1000 to 1800 F air. A statistical correlation was obtained between the measured wear rates under these conditions and the coefficient of friction, the thermal-stress resistance, and the thermal diffusivity of the mated materials on which wear predominated. A mechanism of wear has been evolved based on the foregoing correlation and on the experimental study of friction and wear surface-temperature fluctuations using special transducers and color-motion-picture photography. Promising materials for high-temperature high-speed bearings and seals include $Al_2O_3$-Cr-Mo cermets, SiC ceramics, and TiC-Ni-Mo cermets.

**The Use of Free-Energy Relationships in the Selection of Lubricants for High-Temperature Applications..61—LubS-14**...By F. K. Orcutt, Assoc. Mem. ASME, H. H. Kruase, and C. M. Allen, Battelle Memorial Institute, Columbus, Ohio. 1961 ASME Lubrication Symposium paper (multilithographed; available to March 1, 1962).

As part of a program of developing lubricants and lubrication techniques for high-speed ball bearings operating over the temperature range from room temperature to 1200 F, candidate lubricants were screened in a high-temperature, high-speed, rolling-disk apparatus. Finely divided, inorganic solids suspended in a gas carrier were the principal lubricants selected for the screening evaluations. In order to choose a small number of the most promising compounds from this large group of materials for evaluation, selection criteria were established and applied. These criteria included some of the physical properties that have traditionally been considered important lubricant characteristics. In addition, thermodynamic calculations were used to judge the probability of chemical reaction between prospective lubricants and the substrate materials.

**Testing of Ball Bearings With Five Different Separator Materials at 9200 RPM in Liquid Nitrogen..61—LubS-18**...By J. A. Brennan, Assoc. Mem. ASME, W. A. Wilson, Mem. ASME, R. Radebaugh, and B. W. Birmingham, Cryogenic Engineering Laboratory, National Bureau of Standards, Boulder, Colo. 1961 ASME Lubrication Symposium paper (multilithographed; available to March 1, 1962).

This is a continuation of a program to evaluate ball bearings for use in cryogenic applications. In this phase, loaded ball bearings incorporating five different separator materials were evaluated running in liquid nitrogen at 9200 rpm. The separator materials tested included: Silver-plated forged silicon iron bronze; polytetrafluoroethylene (TFE); filled TFE; TFE impregnated glass fiber; and a copolymer of trifluorochlorothylene and vinylidene fluoride (modified TFCE).

As in previous tests, the nonmetallic, low friction, materials gave better performance than the metallic materials. Also included in this phase of the program was a low-temperature hardness determination.

**Boric Oxide as a High-Temperature Lubricant..61—LubS-17**...By E. Rabinowicz and M. Imai, Massachusetts Institute of Technology, Cambridge, Mass. 1961 ASME Lubrication Symposium paper (multilithographed; available to March 1, 1962).

A number of investigators have recently shown that boric oxide can act as a high-temperature lubricant. This paper describes a series of sliding experiments in the range from room temperature to 2000 F using boron-carbide, steel surfaces lubricated by boric oxide, and, for the purposes of comparison, steel surfaces lubricated by other low-melting solids and supercooled liquids. Boric oxide and the other supercooled liquids all give a peak in their friction-temperature plot at a temperature close to the softening point of the liquid, although the exact position of the peak is to some extent a function of sliding speed and lubricant thickness. However, the metals, which melt abruptly, do not generally show such a peak. Electric resistance and wear measurements show that, with boric oxide, the peak in friction at about 900 F is due to the need to shear the highly viscous lubricant layer, rather than to solid contact effects. At temperatures a little above the peak temperature, boric-oxide lubricates in a hydrodynamic fashion, but above 1400 F it acts as a boundary lubricant, and shows considerable promise in that role.

**The Lubrication of Ball Bearings With Solid Films..61—LubS-11**...By M. J. Devine, E. R. Lamson, and J. H. Bowen, Jr., Aeronautical Materials Laboratory, Naval Air Materials Center, Philadelphia, Pa. 1961 ASME Lubrication Symposium paper (multilithographed; available to March 1, 1962).

A major factor related to wear life for solid-film lubricants is the substrate pretreatment. The function of the pretreatment has been considered to be that of providing better bonding. However, the main effect is proposed to be attributable to micro reservoirs produced by the pretreatment. It is postulated that the effectiveness of the lubricant is related to the size, shape, number, and location of such reservoirs. Based on this concept, ball-bearing applications were explored. It is shown that significant ball-bearing performance life (400 hr at 750 F, 3500 rpm), can be achieved using $MoS_2$-graphite-sodium silicate solid-film lubricant in reservoir-modified ball bearing systems.

## Aviation

**Application of the Stiffness Method to the Analysis of Shell Structures..61—Av-58...** By Bruce E. Greene, Boeing Airplane Company, Bellevue, Wash.; Donald R. Strome, Boeing Airplane Company, Mercer Island, Wash.; and Raymond C. Weikel, Boeing Airplane Company, Seattle, Wash. 1961 ASME Aviation Conference paper (multilithographed; available to Jan. 1. 1962).

A method is presented for performing a linear digital structural analysis of thin shells possessing arbitrary curvature and subject to arbitrary loads. The procedure is an application of the direct stiffness method of structural analysis as discussed in "The Direct Stiffness Method of Structural Analysis," by M. J. Turner, AGARD Meeting, Aachen, Germany, paper presented September 17, 1959. The continuous shell is idealized by means of an aggregate of flat triangular plates monolithically joined at the corners. The loading is replaced by a system of generalized forces placed at the corners of the triangles. Stress resultants and deflections are computed by this method for several examples and are compared with theoretical values.

**A Comparison of Analytical and Experimental Local Heat Fluxes in Liquid-Propellant Rocket Thrust Chambers..61—Av-59...** By William E. Welsh, Jr., Assoc. Mem. ASME, and Arvel B. Witte, Jet Propulsion Laboratory, Pasadena, Calif. 1961 ASME Aviation Conference paper (multilithographed; to be published in **Trans. ASME—J. Engng. for Indus.**; available to Jan. 1, 1962).

Experimental data are presented showing heat-flux distributions measured calorimetrically with several liquid-propellant rocket thrust-chamber configurations. Thrust levels of the experimental chambers were from 300 to 5000 lb. Enzian-type and axial-stream showerhead propellant injectors were utilized with hydrazine ($N_2H_4$) and nitrogen tetroxide ($N_2O_4$) propellants. Nozzle-contraction-area ratios of 8 to 1, 4 to 1, and 1.64 to 1 were tested, each having a 5-in. inlet diameter. Characteristic chamber lengths ranged from 16.95 to 62.8 in.

The comparison between the experimental heat flux and the analytical heat flux and the analytical heat flux using the method of Bartz was found to be closest in the nozzle-expansion region. However, the experimental heat-flux measurements ranged between 80 per cent above and 45 per cent below the analytical estimates at the nozzle throat. These differences were dependent upon thrust-chamber configuration, injector type, and chamber pressure, and apparently resulted from nonideal combustion and flow characteristics.

It is concluded that a priori determination of heat-flux distribution along the thrust-chamber length is possible only to a first approximation for the conditions of these tests.

**Dynamic Balancing of Missiles and Space Probes..61—Av-60...** By David A. Lee and Richard J. Switz, Space Technology Laboratories, Inc., Los Angeles, Calif. 1961 ASME Aviation Conference paper (multilithographed; available to Jan. 1, 1962).

Many of the vehicles used by this country for its satellite and space-probe programs have utilized spin stabilization as a substitute for guidance on one or more of the upper stages. Since all steering must be done before the guided stages are detached from the vehicle, the direction of the thrust vector of subsequent stages must be maintained precisely during and after staging.

In order to maintain this alignment, the unguided stages are spun up about the missile centerline after the last guided stage has burned out (but before it has separated), or the forward stages are spun up on a rotating platform attached to the last guided stage. The effect is the same in either case, in that the angular momentum of the spinning body tends to preserve the direction of thrust by minimizing the effects of staging transients, while the rotation tends to average out any angular-thrust misalignment effects from the burning rocket.

If the rotating objects are to spin about a predetermined axis, the individual stages must be statically and dynamically balanced. A description of the design and use of equipment to accomplish the balance of such rockets and payloads is given.

**Structural Characteristics of Fasteners for Honeycomb..61—Av-57...** By Jack Cherne, Shur-Lok Corporation, Anaheim, Calif. 1961 ASME Aviation Conference paper (multilithographed; available to Jan. 1, 1962).

In the years that potted-in fasteners for honeycomb sandwich material have been used, the design strengths of the particular assembly have been based on specific tests of the configuration involved. However, it is evident that the applications of these structural assemblies are sufficiently similar to each other to allow for the development of a general set of test data emcompassing the majority of variations in construction.

The research reported in this paper was intended to develop enough data to present a spectrum of fastener strengths as affected by sandwich-panel construction. In order to accomplish this, three variables were selected. These are skin thickness, core density, and over-all sandwich thickness. The core material selected was aluminum honeycomb. The skins were 2024 ST aluminum, and the fasteners used were Shur-Lok SL78 potted-in inserts. The results of the tests are presented as a plot of ultimate strength versus panel thickness for various combinations of skin and core densities.

**Molecular and Colloidal Ions for Electrical Propulsion..61—Av-62...** By A. Lucile Cox, Rocketdyne, a division of North American Aviation, Inc., Canoga Park, Calif. 1961 ASME Aviation Conference paper (multilithographed; available to Jan. 1, 1962).

For many space missions electrical propulsion engines can make most efficient use of their power supplies by employing molecular or colloidal ions as the propellant. Both are discussed. The operating conditions in a molecular-ion engine require a propellant of high thermal stability from which the singly charged parent ion is readily produced. Highly conjugated organic compounds appear to meet these requirements. In the case of colloidal-ion engines, a high mass flow rate of particles with uniform charge-to-mass ratios is required. It is concluded that the vapor-jet-rapid-condensation method of colloid production with charging before condensation can best satisfy the propulsion requirements.

**New Joining Processes for Uncommon Materials..61—Av-61...** By R. E. Monroe, Battelle Memorial Institute, Columbus, Ohio. 1961 ASME Aviation Conference paper (multilithographed; available to Jan. 1, 1962).

Many of the uncommon materials that are now being fabricated for advance technical systems are very sensitive to joining processes. As a result, such new processes as electron-beam, ultrasonic, plasmajet, and explosive welding have been pushed rapidly for use with these materials. Other techniques, such as inert-gas-shielded consumable-electrode welding, diffusion bonding, and brazing are being viewed in a new perspective for such applications. This paper reviews the significant characteristics of these processes, to show how the processes can be used to meet material requirements.

The plasmajet is being considered for use in the welding of refractory metals because of the very high temperatures that can be developed with this device. The major problem in adapting this process for welding is to limit the high force accompanying the jet action so that the welding and not cutting will occur. Explosive welding is reported to result in both fusion and nonfusion-joint types.

This process, which is an outgrowth of an undesirable feature of explosive forming, is now the subject of several research programs.

The use of auxiliary vibration during arc welding can provide a method controlling weld-metal grain size, porosity, and perhaps other properties of fusion-welded joints. Welds with smaller grain size have been made both in Russia and in this country with this technique. A major obstacle to the use of this type of welding is the difficulty in suitably coupling vibratory energy to a weld pool. If the problem can be overcome, then the process would be quite attractive for welding materials susceptible to the formation of large grains in the weld area.

**The Application of the Gas Turbine to Ground Cushion Vehicles..61—Av-64...** By Archie P. Kelley and Leslie W. Norman, AiResearch Manufacturing Company of Arizona, Phoenix, Ariz. 1961 ASME Aviation Conference paper (multilithographed; available to Jan. 1, 1962).

Current attention focused on ground-cushion vehicles has evoked many questions regarding the differences between the high performance initially predicted and the relatively low performance now being achieved.

The authors define the ground-cushion vehicle as a flying propulsion system (including air ducts, gas turbine, transmission means, and air mover) and illustrate how a well-integrated gas-turbine propulsion system can mean the difference between mediocrity and optimization. Further considerations include propulsion system weight estimates, various and optimum transmission means, and auxiliary power requirements. The authors illustrate these principles with an actual example of a gas-turbine driven fan duct system designed specifically for GEM application.

**Control of Supersonic Inlets..61—Av-65** ...By T. A. Flanders, United Aircraft Corporation, Windsor Locks, Conn. 1961 ASME Aviation Conference paper (multilithographed; available to Jan. 1, 1962).

Aircraft developments toward high-speed flight have directed considerable interest to variable geometry air-induction systems. Control of these supersonic inlets is of particular interest because of the effects on inlet performance. This paper briefly covers supersonic diffuser operation and typical variable geometry. It then discusses in more detail control parameters, dynamic considerations, physical requirements, typical control hardware, and future trends in inlet control.

Supersonic diffusers have many forms but can be classified as either isentropic, normal shock, or oblique shock inlets. A brief look at each of these inlet types helps to describe the purpose of the inlet and to demonstrate the need for inlet control. It is shown that oblique shock inlet is most attractive for high Mach-number flight. For this reason an oblique shock inlet is chosen as typical for this paper to allow more specific discussion of inlet controls.

**The Efficient Design of Truss-Core Sandwich Plate for Spacecraft..61—Av-66...** By Dewey G. Younger, Jr., Aeronutronic Division of Ford Motor Company, Newport Beach, Calif. 1961 ASME Aviation Conference paper (multilithographed; available to Jan. 1, 1962).

A minimum-weight design approach is presented for the structural shell of manned spacecraft, and design charts are included that permit the efficient introduction of both the meteoroid shielding and the requirements on thermal control. The scope of the paper is restricted to directional-core, double-wall construction of the truss-core type. Nevertheless, the method is equally valid for all types of directional-core construction whose principal modes of failure can be described as Euler instability and local buckling.

**An Economic Analysis of Various Liquid Propellant Booster Systems..61—Av-67** ...By S. F. Iacobellis and H. C. Wieseneck, Rocketdyne, a division of North American Aviation, Inc., Canoga Park, Calif. 1961 ASME Aviation Conference paper (multilithographed; available to Jan. 1, 1962).

The cost of developing and producing a liquid rocket engine is discussed and analyzed. The influence of thrust level, propellants, feed system, production quantity, and operating characteristics are evaluated.

As thrust level increases, the development and production costs per pound of thrust decreases rapidly. This point is illustrated by two contemporary engines. One produces ten times the thrust but costs considerably less than ten times the other. A relationship is presented that shows the significance of production quantities on engine cost. The importance of propellant, feed system, and parameter selection are also indicated.

It is shown that with recovery techniques and other developments the rocket-engine cost per flight may approximate 3 per cent of current values.

**The B-52 Towing Tug Hydraulic System—A New Shelf Hardware Design Concept..61—Av-68...** By J. O. Byers, Jr., Vickers, Inc., Waterbury, Conn. 1961 (multilithographed; available to Jan. 1, 1962).

One of the major environmental problems associated with the global deployment of air power is the ground handling of heavy jet-powered aircraft on ice-covered runways. A prime example is the Boeing B-52 Stratofortress—an aircraft that "weighs in" at something in excess of 300,000 lb without armament. Currently, the B-52 is being operated from a number of bases where arctic weather conditions are commonplace.

Air Logistics Corporation of Pasadena, Calif., under a contract with the U. S. Air Force, tackled the problem of designing, developing, and manufacturing a ground-towing tug that would have the capability of towing and maneuvering the B-52 under all weather conditions.

The vehicle that resulted is unusual in concept, unique in certain features, and so satisfactory in performance that Air Log now has a production contract with the Air Force.

The part played by the author's company in solving the design, development, and manufacturing problems for this aircraft ground-towing tug is described. The objective of the contractor, Air Logistics Corporation, was to design a vehicle having optimum performance within the specifications, to be manufactured of as near standard components as possible in the shortest possible time. In meeting these objectives the author's company acted as consultants throughout the design phase in advising what standard hydraulic components were available as off-the-shelf items to perform power-transmission functions.

## Oil and Gas Power

**Cycle Analysis From Combustion Equations..61—OGP-2...** By Leo T. Brinson, Jr., Mem. ASME, Nordberg Mfg. Company, Milwaukee, Wis. 1961 ASME Oil and Gas Power Conference paper (multilithographed; available to Feb. 1, 1962).

In a two-stroke cycle engine the cylinder volume is not usually 100 per cent effective because the exhaust gas from the previous cycle is not completely expelled. The residual exhaust gas is detrimental because it occupies space which the fresh-air charge should fill, and it heats the mixture of residual gas and fresh air so that the density is reduced.

A method is presented of evaluating the scavenging efficiency of a two-stroke cycle diesel engine based solely on data obtained from the particular engine under test. Incidental data from a single cylinder engine are included only for the purpose of demonstrating the validity of the procedure and the quality of results

which can be achieved. Comparison of test-engine thermal efficiency with the theoretical thermal efficiency shows good correlation through the use of a "diagram factor" which is substantially constant for a given engine.

**Electrochemical Cylinder Corrosion.. 61—OGP-3**...By J. M. A. Van der Horst, Mem. ASME, Van der Horst Corporation of America, Olean, N. Y.; and W. A. Schultze, Lemet Chromium N. V., Hilversum, Holland. 1961 ASME Oil and Gas Power Conference paper (in type; to be published in **Trans. ASME—J. Engng. for Power;** available to Feb. 1, 1962).

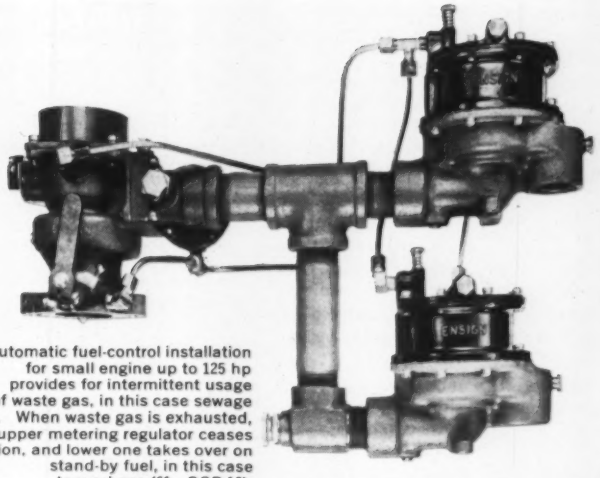
The price differential between distillate and residual fuels tends to increase rather than decrease, offering a growing incentive to the use of residuals in diesel engines. In general, no specifications can be put upon residuals without largely eliminating the price advantage. Therefore special measures must be taken to insure trouble-free operation on residual fuels. Significant strides have been made in this direction especially with regard to lubricants. New developments in protective lubrication, engine tests, and service results are discussed.

It is the authors' opinion that very low rates of cylinder wear can be attained in large diesel engines operating on heavy fuel when the following points are adhered to: (*a*) chromeplated liners; (*b*) chrome with channel type porosity; (*c*) properly designed oil grooves; (*d*) tailor-made emulsion lubrication.

**Trends in Marine Diesel Fuel for the Navy..61—OGP-4**...By Eugene C. Davis, Navy Department, Bureau of Ships, Washington, D. C. 1961 ASME Oil and Gas Power Conference paper (multilithographed; available to Feb. 1, 1962).

Over the years, the Navy has purchased a straight-run diesel fuel. The present specification for Marine Diesel Fuel MIL-F-16884 allows no cracked components in the fuel blend. This has been considered necessary in order to insure the storage stability required of fuels subjected to many years of storage and extremes of temperature in Naval Depots throughout the world. Straight-run distillates give the greatest assurance of this stability. The Bureau of Ships has realized, however, that in time of national emergency the available supply of straight-run diesel fuel, such as is presently purchased, may not be adequate. It would therefore be necessary to procure a blend of straight-run and cracked distillates.

This paper reviews the research and development work leading to a test procedure for predicting the storage stability of distillate fuels. This test procedure is applicable to the differentiation between stable and unstable cracked distillates or blends of cracked and straight-run distillates. A description of the types of distillate fuel to be used for diesel engines in Naval service during the 1960's is given.



Automatic fuel-control installation for small engine up to 125 hp provides for intermittent usage of waste gas, in this case sewage gas. When waste gas is exhausted, upper metering regulator ceases operation, and lower one takes over on stand-by fuel, in this case tnaural gas (61—OGP-12).

**Evolution and Development of a 900-Hp Marine Diesel Featuring Ruggedness and Serviceability in a 4½ lb/hp Package.. 61—OGP-5**...by L. Wechsler, Bureau of Ships, Navy Department, Washington, D. C.; L. Thompson and E. Tsakiris, Curtiss-Wright Corporation, Utica, Mich. 1961 ASME Oil and Gas Power Conference paper (in type; to be published in **Trans. ASME—J. Engng. for Power;** available to Feb. 1, 1962).

The authors describes the design evolution and basic features of a new 900-hp lightweight, heavy-duty diesel engine. Discussions show how early field experience in lightweight diesel engines guided special engineering studies, which eventually established important features of the new engine. The paper includes technical data regarding certain design parameters important in lightweight engine construction plus performance data of the 900-hp engine. Photographs show the new engine and many of its major components.

**A Multifuel-Engine Experience 61—OGP-6**...By Walter F. Isley, Continental Aviation and Engineering Corporation, Detroit, Mich. 1961 ASME Oil and Gas Power Conference paper (multilithographed; to be published in **Trans. ASME—J. Engng. for Power;** available to Feb. 1, 1962).

Continental, through contract with the U. S. Army Ordnance Corps, has developed a multifuel diesel engine capable of burning combat gasoline. This engine is of conventional design except for those features that contribute to its multifuel capabilities. These features include the hypercycle combustion system, a special intake swirl port, a water-jacketed intake manifold, and a manifold flame heater for cold starting. Engines have been installed in Army M35, 2½-ton trucks and extensively tested on the intended fuels under arctic temperature and desert conditions, during which the multifuel capabilities have been clearly demonstrated.

**Automatic Gaseous Fuel Controls..61—OGP-12**...By Ralph G. Abbott, American Bosch Arma Corporation, Springfield, Mass. 1961 ASME Oil and Gas Power Conference paper (multilithographed; available to Feb. 1, 1962).

In sewage-treatment plants, oil-gathering systems, blast-furnace operations, and many others, there are available substantial quantities of waste gases that are readily burnable in a spark-plug engine. The supply of each of these gaseous fuels can be intermittent as it is a by-product of some process which in itself is not necessarily constant.

To use these no-cost, intermittently available, waste-product gases requires an automatic device that will switch the fuel supply from the intermittent source to a constant stand-by gas source and then back to the intermittent source when the waste gases are again available.

Such a device is described for switching the gaseous fuel supply for a spark-ignition engine from an intermittently available low-cost or waste gas, to a higher Btu stand-by gas until the low-cost waste gas is again available.

**Operation and Maintenance of Metallic-Rod Packings for Reciprocating Compressors ..61 — OGP - 13** ... By Gilbert Wilkes, III, France Packing Company, Philadelphia, Pa. 1961 ASME Oil and Gas Power Conference paper (multilithographed; available to Feb. 1, 1962).

The purpose of mechanical packing is

to prevent the loss of gases from the cylinder along the piston rod. In order to achieve this end the packing unit must effect a seal on the piston rod that will compensate for wear, misalignment, and temperature variations of the unit.

The reciprocating compressor used in today's petroleum and petrochemical industry is called upon to operate at higher speeds, pressures, and temperatures while handling a wider variety of gases than were dreamed of years ago. In addition to the technological advances in metallic-rod packing design resulting from these advanced service requirements, a need for more precise installation, run-in, and maintenance techniques on metallic-rod packings has arisen. It is the purpose of this paper to define basic metallic-packing design and theory of operation as well as installation, run-in, and maintenance techniques on reciprocating-compressor metallic-rod packings.

**Performance of Spark Ignition 4-Cycle Engines on Various Fuels..61—OGP-14...** By C. E. Holvenstot, Ingersoll-Rand Company, Painted Post, N. Y. 1961 ASME Oil and Gas Power Conference paper (multilithographed; available to Feb. 1, 1962).

The author's company conducted extensive tests from 1953 to 1956, making comparisons of engine performance on methane, propane, iso-butane, normal-butane, hydrogen, and various mixtures of these fuels, on an $8^1/_4 \times 9$ naturally aspirated engine running at 550 rpm. Some of these test results are described, as well as field experiences with unusual fuels in larger engines, both naturally aspirated and supercharged.

Deciding whether an engine should be sold for a given fuel, known to be inferior to sweet natural gas, presents a difficult problem to the engine manufacturer. The tests described here were useful in providing more knowledge and confidence in dealing with fuel containing hydrogen and butanes.

**Operation of Dual-Fuel Engines in Pipeline Service..61—OGP-1...** By Erik Kelgard, Trans Mountain Oil Pipe Line Company, Kamloops, B.C., Canada. 1961 ASME Oil and Gas Power Conference paper (multilithographed; available to Feb. 1, 1962).

For best fuel economy, dual-fuel engines should be so arranged that when the engine is operated as a gas diesel, combustion-air quantity is reduced to about 75 per cent of that required for the engine when operating as an oil diesel. Changes in ambient temperature affect fuel efficiency. For variable-load, variable-speed engines, changes in pilot fuel timing and quantity as a result of speed changes also affect economy. Fuel savings of up to 20 per cent are considered possible through control of these variables.

**Application of a Resilient Coupling to Avoid Resonance in a Diesel Engine Installation..61—OGP-9...** By Arthur S. Herman, Jr., Assoc. Mem. ASME, Koppers Company, Inc., Baltimore, Md. 1961 ASME Oil and Gas Power Conference paper (multilithographed; available to Feb. 1, 1962).

The design of a resilient coupling, and its application to a diesel-engine drive to avoid resonance at operating speed are described in this paper. Test results obtained while running the installation at resonant speed are also given.

Testing of the coupling consisted of the following two phases:

1 Thirty-eight normal starts and stops were made to establish the characteristics of the fourth-order resonance.

2 An accelerated test was conducted, operating the engine in fourth-order resonance for a total time of 34 min 15 sec, running in 2-min intervals. (After each 2 min of running time, the cover plate of the coupling was removed and the temperature at the surface of the rubber blocks was measured to insure that the heat build-up would not exceed that which could be expected in normal service. The temperature rise after running 30 min at 720 rpm was 5 deg F above room temperature of 86 F; temperature rise from start to finish of running in resonance was 41 deg F to a maximum temperature of 132 F, as compared to a room temperature of 91 F.)

**Wave Phenomena and Conditioning of Induced Air and Exhaust Gas in the Operation of Internal Combustion Engines..61—OGP-7...** By B. G. Golden, Burgess-Manning Company, Dallas, Texas. 1961 ASME Oil and Gas Power Conference paper (multilithographed; available to Feb. 1, 1962).

Pulsation and its effect upon cylinder scavenging and engine performance are projected by a simple mechanical analogy. Optimum conditioning of wave phenomena and noise (relevant to the operation of an internal-combustion engine) by the "snubber" principle is enumerated through analytical and empirical reasoning.

**Turbocharger Selection, Matching and Development for Two-Cycle, Spark Ignition Gas Engines..61—OGP-10...** By W. H. Payne, Mem. ASME, G. H. Bollman, and R. L. Johnson, Assoc. Mem. ASME, Clark Brothers Company, Olean, N. Y. 1961 ASME Oil and Gas Power Conference paper (multilithographed, available to Feb. 1, 1962).

The authors describe what conditions a turbocharger must meet to satisfy or match a given engine's requirements and state the characteristics of the turbocharger components and performance, such as flow, head, and efficiency, that are necessary for use with a two-cycle spark-ignited gas engine. Graphs are presented showing the operating characteristics of a turbocharger compressor and turbine, and these are used to discuss the matching of the turbocharger to the engine. Development problems are discussed relating to altitude applications and the shifting of blower and turbine flow capacities to meet several engine requirements. Application of turbocharger test stands as well as the turbocharger-engine altitude test facilities are shown. Various turbochargers developed by the authors' company are described.

**The Way to Automate—A Diesel Utility.. 61—OGP-8...** By R. D. Hamilton, The Cooper-Bessemer Corporation, Mount Vernon, Ohio—Grove City, Pa. 1961 ASME Oil and Gas Power Conference paper (multilithographed; available to Feb. 1, 1962).

Complete automation has been accomplished at the Nantucket Gas and Electric Utility. The design philosophy and details of this system are outlined to answer the question—what is necessary for complete automation of a diesel utility?

The paper explains how it is done. Complicating this installation are three different sizes of engines and the handling of residual fuel. The push button has been eliminated and the whole station is operated unattended for a good part of the day.

This automation required:

For the Engine:

1 Sequence starting.
2 Alarm monitoring.
3 Shutdown protection.
4 Complete fuel-system automation (this includes automatic fuel change from No. 2 diesel to and from residual fuel operation).
5 Auxiliary sequence control (including pre and postlubrication).
6 Cooling-system automation.
7 Lubricating-system controls.

For the Station:

1 Engine-order selection.
2 Engine bypass ability.
3 Sen-s-tron start and stop signal and control.
4 Automatic synchronizing.
5 Unit load sharing.
6 Dead buss starting.
7 Residual-fuel handling and cleaning.
8 Alarm monitoring.
9 Shutdown protection.

**Current Trends in Engine Control Application..61—OGP-11...** By C. R. Carmichael, Amot Controls Corporation, Richmond, Calif. 1961 ASME Oil and Gas Power Conference paper (multilithographed; available to Feb. 1, 1962).

In light of the rapidly expanding use of function and safety devices for prime movers, several basic system philosophies are presented. To illustrate these trends major design considerations as well as operational and economic features are analyzed in the four major fields of:

1 Mobile power units (railroad, marine, and so on).

2 Small stationary power plants (municipal industrial).

3 Medium-sized central plants.

4 Pipeline-transmission stations.

## Gas Turbine Power

**A Gas Turbine "CO" Boiler Installation; Economic and Thermodynamic Analysis..61—GTP-1...** By Charles Bultzo, Mem. ASME, Humble Oil and Refining Company, Baytown, Texas. 1961 ASME Gas Turbine Power Conference paper (multilithographed; available to Jan. 1, 1962).

Essential to fluid-catalytic-cracking operation is the need for regeneration air. During the time of reaction in the hydrocarbon stream, carbon is deposited on the catalyst. In order to remove this carbon, air is supplied in the regenerator and the carbon removed by burning, which produces large amounts of CO and $CO_2$. The CO, $CO_2$, $N_2$, $H_2O$ (due to burning of some hydrocarbons), and remaining $O_2$ are separated from the catalyst by cyclones. Usually some form of waste-heat recovery is employed to utilize the sensible heat in this gas stream.

A detailed thermodynamic analysis is given of a combined gas-turbine "CO" boiler installation. Regenerator flue gas with 9 per cent CO is burned to $CO_2$ using gas-turbine exhaust which contains 17 per cent $O_2$. In addition, the first costs of a steam-turbine drive is compared to that of the gas-turbine installation. The summary is a comparison of the anticipated efficiency with those being experienced.

**Standby Power for Hydro-Quebec Uses Gas Turbines..61—GTP-4...** By H. W. Haberl, Quebec Hydro Electric Commission, Montreal, Que., Canada, and D. F. Abel, Canadian General Electric Company, Ltd., Peterborough, Ont., Canada. 1961 ASME Gas Turbine Power Conference paper (multilithographed; available to Jan. 1, 1962).

The Province of Quebec, the largest province in Canada, is an ideal source of hydraulic energy except for that portion of the province located south of the St. Lawrence River known as the Gaspé Peninsula. This area lies north of the State of Maine and of the Canadian Province of New Brunswick. In the Gaspé area there is an insufficient amount of hydraulic energy to supply this portion of the province's growing electrical requirement.

To supplement the Gaspé Peninsula's electrical requirement it was logical to supply power from hydraulic energy available on the north shore of the St. Lawrence River, and 69-kv cables were installed at a point 32 miles wide.

However, some form of standby power was required in case of cable maintenance or other causes that might constitute a long outage time. After considerable study, with time as a factor, it was decided in early 1960 to purchase and install a gas turbine-generating plant as this form of standby. Investigations show that units of about 8000 hp and generators of 6000 kw could be obtained and installed within six months. The work was started in early 1960 and the first unit was delivered to the job site and placed on foundation in mid-June. Six units were purchased, two units being bussed to one transformer bank. The plant produced electrical energy by July, 1960.

The installation is described, as is its building design, arrangement of equipment, and method of operation.

**Materials Keep Pace With Industrial Gas-Turbine Needs..61—GTP-15...** By Harry B. Geyley, Westinghouse Electric Corporation, Philadelphia, Pa. 1961 ASME Gas Turbine Power Conference paper (multilithographed; available to Jan. 1, 1962).

Reliability and improvements in industrial gas turbines are closely related to the materials study programs conducted in support of the turbine design. The studies at the author's company are described with presentation of blade and disk material data. Field experience as related to materials evaluations are described, with particular emphasis on returning parts to service. Materials now available when fully evaluated, through the program described, will permit metal temperatures 100 degrees F higher than currently used.

**A 7500-SHP Gas Turbine for Naval Boost Propulsion..61—GTP-5...** By F. R. Harris, Associated Electrical Industries, Ltd., Manchester, England. 1961 ASME Gas Turbine Power Conference paper (multilithographed; available to Jan. 1, 1962).

The G.6 gas turbine, of 7500-shp output, forms part of the combined steam-turbine and gas-turbine propulsion machinery currently being installed in two classes of British naval ships. The design specification included some requirements of a novel nature; details are given of the mechanical construction of the gas turbine, and of its test-bed performance. The possibilities of further development are outlined.

The G.6 gas turbine bears a strong family resemblance to the previous naval boost gas turbines. Some of the principal features are:

1 The annular combustion chamber, used in all previous designs, was abandoned and six flame tubes were used.

2 The compressor-inlet casing now faced vertically upward, not axially as in previous machines.

3 The compressor blading was completely in aluminum bronze.

4 The compressor fixed blading was unshrouded at the outlet end, but at the inlet end five stages were built into diaphragms, as in conventional steam turbines.

5 Both turbines were two-stage, overhung back to back, and each turbine casing was fitted with liners to reduce distortion due to temperature gradients.

**Transient Temperatures and Thermal Stress Problems in Small Gas Turbines..61—GTP-13...** By Robert R. Van Nimwegen, AiResearch Manufacturing Company of Arizona, Division of The Garrett Corporation, Phoenix, Ariz. 1961 ASME Gas Turbine Power Conference paper (multilithographed; available to Jan. 1, 1962).

A discussion is given of the steady and transient temperature problems associated with the design of small gas turbines and starter equipment. The transient heat-conduction equation is given in differential and finite-difference form. Boundary conditions of convective heat transfer, radiation, and prescribed temperatures are discussed.

Several methods for solution of these equations in irregularly shaped bodies are given. Examples of solutions of typical temperature problems in small gas turbines are shown. Solution by means of an electrolytic tank, an analog computer, and a digital computer are discussed. The advantages and disadvantages of each method are given.

**Technical Considerations in the Development of a Maritime Gas-Cooled Reactor System..61—GTP-14...** By Bernard T. Resnick, Office of Research and Development, Maritime Administration, Washington, D. C. 1961 ASME Gas Turbine Power Conference paper (multilithographed; available to Jan. 1, 1962).

The maritime gas-cooled-reactor concept is a closed-cycle nuclear propulsion system in the 20,000-shp range. The power cycle consists of a beryllium-oxide,

helium-cooled reactor, directly coupled to a closed-cycle axial-flow, split turbine. The high-pressure turbine drives the directly connected helium compressors. The low-pressure turbine drives the propeller shaft through a suitable speed reducer. Problems relating to the design development of principal plant components and systems, and the current status of turbomachinery and reactor technology are discussed.

**Design and Development Review of the T64 Turboprop/Turboshaft Engine..61—GTP-7**...By Frederic F. Ehrich, Assoc. Mem. ASME, General Electric Company, West Lynn, Mass. 1961 ASME Gas Turbine Power Conference paper (multilithographed; available to Jan. 1, 1962).

The T64 is a turboshaft/turboprop aircraft engine under development by the Small Aircraft Engine Department of the author's company for the U. S. Navy Bureau of Weapons. A summary is given of the basic design criteria for the engine as well as a brief description of the engine configuration and high lights of engine development experience.

Discussed are the main reduction gear, control and fuel system, engine-accessory drive, anti-icing system, compressor, bearings and lubrication system, combustion section, gas-generator turbine, power turbine, turbine cooling system, and the electrical system and instrumentation.

**Operation of 8500-Hp Gas Turbines in Locomotive Service..61—GTP-8**...By H. Rees, Union Pacific Railroad Company, Omaha, Neb. 1961 ASME Gas Turbine Power Conference paper (multilithographed; available to Jan. 1, 1962).

Gas turbines of 8500 hp in locomotive service on the Union Pacific Railroad have accumulated over 95,000 fired hr since the first locomotive was placed in main-line duty September, 1958. Nineteen locomotives are now operating; 11 more were to be delivered by July, 1961. The rugged conditions of railroad service are ideal for accelerated field testing. Improvements developed from operation of the first turbines were incorporated in all turbines delivered later. This field development is expected greatly to reduce maintenance and improve reliability of the entire fleet. The power plant is a new model General Electric frame size 5, simple-cycle, single-shaft, two-bearing machine having a 16-stage axial compressor and two-stage turbine.

To describe the problems associated with the 8500-hp gas turbines, the author reviews all occasions when turbines were partially or completely opened for interior examination. The turbine casing has a horizontal split that permits removal of the top half with the turbine in the locomotive. All parts can be removed and replaced, except compressor-rotor blades.

**Seapower: Gas Turbines Add Fighting Punch..61—GTP-10**...By Ralph K. James, Bureau of Ships, Navy Department, Washington, D. C. 1961 ASME Gas Turbine Power Conference paper (multilithographed; available to Jan. 1, 1962).

Steadily rising shipbuilding costs, the approaching block obsolescence of the bulk of our active fleet, and the rapid advance of weapons technology are the major problems facing the U. S. Navy today. The ability of the gas turbine to make important contributions to combating each of these problems has resulted in a rapid rise in its use. Specific current programs and applications are discussed.

Only one phase of the Navy's progress in prime mover development is presented; namely, the rapid expansion in the development and use of the gas turbine in increasing the fighting effectiveness of ships, amphibious vehicles, and supporting equipment, at the minimum practicable cost.

**Design Considerations and Operating Experience of Regenerators for Industrial Gas Turbines..61—GTP-12**...By R. F. Caughill, General Motors Corporation, Lockport, N. Y. 1961 ASME Gas Turbine Power Conference paper (multilithographed; available to Jan. 1, 1962).

The gas-turbine regenerator or recuperator is a heat exchanger used to improve specific fuel consumption by the recovery of energy from the waste heat in the exhaust gases.

A brief review is given of the general specifications including performance requirements, operating conditions, and installation. Some of the design restrictions that were considered from a practical manufacturing viewpoint are indicated, as well as some of the basic research that has taken place over a period of years. Field testing and operating experience are vital contents of the paper.

**Segregated Structures in Highly Alloyed Ferritic Gas-Turbine Wheel Forgings..61—GTP-9**...By G. R. Heckman and A. W. Herbenar, General Electric Company, Schenectady, N. Y. 1961 ASME Gas Turbine Power Conference paper (multilithographed; available to Jan. 1, 1962).

The problem of segregation in large modified 12 per cent Cr gas-turbine wheel forgings are illustrated by the results of three major metallurgical investigations undertaken by the Materials Engineering activity of General Electric's Gas Turbine Department. These are as follows:

1 The investigation of a brittle failure involving a first-stage locomotive turbine wheel during qualification tests.

2 The investigation associated with high-temperature, low-energy-type failure of a second-stage wheel during the hot-prestressing phases of proof testing.

3 The investigation of a re-evaluated and reprocessed first-stage turbine wheel removed from service because of an apparent change of a sonic indication.

**Use of Experimental Interstage Performance Data to Obtain Optimum Performance of Multistage Axial Compressors..61—GTP-3**...By Laurence E. Brown, Mem. ASME, and Fred G. Groh, Curtiss-Wright Corporation, Quehanna, Pa. 1961 ASME Gas Turbine Power Conference paper (in type; to be published in **Trans. ASME—J. Engng. for Power**; available to Jan. 1, 1962).

A technique is presented whereby performance of individual stages can be depicted graphically upon the performance map of an over-all multistage compressor. Through this presentation the individual and over-all effects can be examined together. Insight is afforded into performance relationships of one stage to another, and faults can be diagnosed if any exist in the matching, radial or axial, of individual stages. Changes of blade geometry can then be prescribed upon a clear and explicit basis. To illustrate use of the technique, data are presented describing gains achieved experimentally.

## Textile Engineering

**Cotton—Mechanics of Ginning and Effects on Quality..61—Tex-1**...By James A. Luscombe, U. S. Department of Agriculture, Clemson, S. C. 1961 ASME Textile Engineering Conference paper (multilithographed; available to Jan. 1, 1962).

Ginning is one of a series of operations in cotton production that makes fibers available for spinning and other manufacturing purposes. It converts harvested material into salable products of seed and lint, and seeks to preserve their inherent qualities during flow through the eight basic systems of a ginning plant. These systems, which are discussed and illustrated, are: process control, conditioning, preparing, ginning, cleaning, packaging, quality evaluation, and supplementary.

The systems of a ginning plant are designed to enhance the end-use value of a package of ginned fibers by establishing levels of moisture and extraneous matter commensurate with certain other quality factors. The mechanics of ginning do not improve the inherent fiber qualities resulting from growing and harvesting operations nor do they forestall damage or loss due to poor judgment in management of operations following ginning.

**The MAXBO Shuttleless Loom..61—Tex-2.** By Raleigh J. Farr, Edda International Corporation, Greenville, S. C. 1961 ASME Textile Engineering Conference paper (multilithographed; available to Jan. 1, 1962).

The idea of the Maxbo shuttleless loom first came into the mind of a young Estonian engineer, Max Paabo, in 1936. After much thought and crude experiments, he became convinced that a loom could weave without a shuttle. After three years of work on the idea, World War II stopped the work of Mr. Paabo. He spent three years in a German concentration camp before escaping to Sweden. In Sweden, he found the people to back his idea of using compressed air to replace the shuttle. In 1946, the Swedes went all out to perfect the loom, which is described in this paper.

The Maxbo loom is a precision piece of machinery having very little engineering resemblance to the fly-shuttle or conventional loom.

The completely new method of inserting the weft (filling) by pneumatic pressure (compressed air) eliminates the need to dwell the shedding motion for a mechanical weft (filling) carrier to enter and leave the shed. This makes possible the very high weaving speed. The loom operates from 330 ppm up.

**The Shuttleless Loom..61—Tex-3...** By A. E. McKenna, Clemson College, Clemson, S. C. 1960 ASME Textile Engineering Conference paper (multilithographed; available to Jan. 1, 1962).

Conventional looms, their functions and limitations, and the advantages and disadvantages of several new shuttleless looms lately introduced to commercial practice are reviewed. This paper forms the basis of a panel discussion on shuttleless looms.

In commenting on the shuttleless loom, mention is made of the increased speed of the loom resulting in greater production. Other factors are the elimination of filling preparation and the cost of bobbins and shuttles. By doing away with the shuttles, many of the troubles and second quality of cloth of loom operation are removed. It is concluded that shuttleless weaving should offer more consistent loom operation with fewer cloth defects.

**Cotton—Some Aspects of Quality as Related to Manufacture..61—Tex-4...** By John E. Ross, Agricultural Marketing Service, USDA, Clemson, S. C. 1961 ASME Textile Engineering Conference paper (multilithographed; available to Jan. 1, 1962).

Effects of certain harvesting and ginning practices on spinning performance and operation level are discussed. Spinning procedures employed in testing and a review of the modern gin of today with its effect on grade, quality, and price, are included.

This paper resulted from joint research programs of several Divisions of Agricultural Marketing Service and Agricultural Research Service.

The goals of AMS quality research, over a period of time are to:

1 Provide a basis for correcting possible abuses to the inherent, end-use value of cotton as it moves from producer to consumer.

2 To develop better instruments for rapid, accurate, and economical measurements of cotton quality and manufacturing performance.

ASME TRANSACTIONS

**Journal of Engineering for Power**

The July, 1961, issue of the Transactions of the ASME—*Journal of Engineering for Power* (available at $1.50 per copy to ASME Members, $3 to nonmembers)—contains the following:

Résumé of Transonic-Compressor Research at NACA Lewis Laboratory, by Seymour Lieblein and I. A. Johnsen. (60—WA-97)

Shock Losses in Transonic Compressor Blade Rows, by G. R. Miller, G. W. Lewis, Jr., and M. J. Hartmann. (60—WA-77)

Critical High Lights in the Development of Transonic Compressor, by R. O. Bullock. (60—WA-290)

A Review of Supersonic Compressor Development, by J. F. Klapproth. (60—WA-294)

Résumé of Compressor Research at the NACA Langley Laboratory, by M. Savage, E. Boxer, and J. R. Erwin.

Some Investigations Into Transonic Axial-Flow Compressors With High Stage Load Coefficients and Low Degrees of Reaction, by K. E. Wichert. (60—WA-310)

The J83 Seven-Stage Transonic Compressor, by J. A. King. (60—WA-93)

Aerodynamic Design and Performance of Five-Stage Transonic Axial-Flow Compressor, by Karl Kovach and D. M. Sandercock. (60—WA-229)

A Practical Method of Predicting Transonic-Compressor Performance, by W. C. Swan. (60—WA-191)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# COMMENTS ON PAPERS

## Welded Surface Plates

**Comment by H. S. Sizer**[1]

WHEN the accuracy of a surface plate must be 0.0001 in/ft or better, the deflection of the plate due to its own weight or due to the weight of the work placed upon it becomes important. It is interesting that the author of this paper[2] has taken advantage of steel with its 30 million modulus to keep deflection under control. By placing metal where it will make its best contribution to the moment of inertia of the section, weight has been decreased and stiffness increased. These moves are good.

When it comes to errors produced by changing temperatures, I feel the author is on weak ground in suggesting that steel will be better than cast iron. Reliable measurements almost always are predicated on a constant temperature. It is hard to know where you are with your work or with your measuring instruments if temperature is changing. It is particularly necessary that the work to be tested and the surface plate on which it is to be checked should be of the same temperature. If there is a difference of temperature, there will be an immediate heat flow between the contact surfaces, and the change in temperature on the test surface of the surface plate is almost certain to cause bowing. Steel is as sensitive as cast iron to this shock and I would expect that a constant temperature would be necessary to get consistent markings.

[1] Director of Design Machine Tools, Brown & Sharpe Manufacturing Company, Providence, R. I. Fellow ASME.

[2] A. H. Kleinsorge, "Welded Surface Plates," MECHANICAL ENGINEERING, vol. 83, March, 1961, pp. 52–54.

**Author's Closure**

Thanks to H. S. Sizer for his comments.

We certainly agree that reliable measurements should be taken at a constant temperature. But as stated in the last paragraph of page 1 of the paper,[2] "Most machine shops are not air conditioned. Wide changes in temperature are experienced from the cool of the morning to the heat of a summer afternoon." Even so, the workpiece and the surface plate should be of the same temperature, or else there will be an "Immediate heat flow between the contact surfaces" causing bowing. Just such an example of uneven temperature change is described in the paper, paragraph number 5, page 3, and illustrated in Fig. 7.

We would agree with Mr. Sizer that "Steel is as sensitive as cast iron to this shock" if all factors could be equal. However, all factors are not equal since cast iron cannot be fabricated in a true box section, symmetrical about the neutral axis, as pointed out in the paper. Thermal expansion is not a metallurgic problem of steel versus cast iron, but rather a problem of design and fabrication to insure uniform expansion.

Precise temperature control is, of course, the best answer to thermal expansion. Until all shops have it, welded surface plates will help overcome the thermal problem.

A. H. Kleinsorge.[3]

[3] Chief engineer, W. B. Knight Machinery Company, St. Louis, Mo.

## What's in a Name?

**To the Editor:**

As ENGINEERS, we all perceive and agree with the sentiments expressed in Philip Sporn's article.[4] But, should it not be the task—in fact, the most important duty—of the national engineering societies to protect our interests and see to it that the engineer's professional standing is respected and honored? Other professions are able to accomplish that feat, and without much difficulty, even without the resources that we have at our disposal.

Take, for an example, the AIA: They are forever drumming on the theme

[4] Philip Sporn, "The Case for the Engineer," MECHANICAL ENGINEERING, vol. 83, June, 1961, pp. 42–44.

LETTERS

"that the engineer has no right to design structures intended for human habitation or occupation." They are now including factories and A-bomb shelters in that concept—and, gentlemen, have you seen some of the "Bomb Shelters" designed by our learned colleagues? After presenting the architects with the necessary formulas for the calculation of simple beams, without requirement of additional understanding of the simple laws of nature, they have the colossal gall to undertake a national campaign designed to exclude us from their "field." And the fact that they are succeeding in creating a monopoly for themselves, in face of existing antitrust laws and age-old precedence, is indeed a slap in the face to the engineering profession.

Or, take the case of our state laws regulating the practice of professional engineering. Should there be any need for the present "mess" of contradictory, monopolistic, and hamstringing regulations restricting every move of the consulting engineer in every state of the union? These are fertile fields for the engineering societies to work in. Let us not wait until conditions reach a stage where only a national trade union will be able to turn the tide. Let us do a little hustling and return the profession

to the level where we can honestly recommend it to our children for their life's work.

Gosta R. Truedsson.[5]

**To the Editor:**

THE CONFUSION between "scientist" and "engineer" which your June editorial covers is a vital subject.

It is not just the public or laymen that are confused but the trouble has gone deep enough into educational circles so that recently one large university got so "scientific" that they lost their accreditation as an engineering school.

It is not just semantics either. There are many definitions for an engineer and still more for a scientist. Although both look alike, talk the same language, and use the same equipment, there is a basic difference. The scientist attempts to discover the laws of nature—for which there can be only one irrevocable right answer. The engineer adapts these laws of nature to the uses of man. For any problem there may be many answers, more or less desirable, depending on the combination of laws used, and always subject to improvement as new laws are discovered and new situations arise.

The engineer is concerned not only with the laws of physics and chemistry (what the public calls "science") but with all the humanities—sociology, economics, law, and the like. Time and energy (equated as wealth) are just as important factors in economic laws as they are in Newton's laws of motion. The raw material with which the engineer works is the product of the scientist who has gone before.

Perhaps those words "gone before" are the key to our present difficulty. Mr. Sporn touched on the idea in his paper,[4] but it needs elaboration. The basic knowledge of steam was centuries ahead of Newcomen. Faraday, and Maxwell, and so on, were years ahead of Edison and Westinghouse. The gap, however, between scientific discovery and technological use has been closing fast until now the "Sales Departments" are taking down payments on trips to the moon while the harassed engineers are breathing down the necks of the scientists to find out how to do it.

The critical change came in World War I. It was a war of technology and the engineers had to dig deep into the store of scientific knowledge much of which had never been put to use. They lowered the reservoir of untried scientific knowledge. The booming twenties pulled the reservoir still lower, applying new knowledge faster than it was being discovered. World War II sucked the "pipeline" dry, so that pure scientists were invited to sit in the meetings with engineers and each started to take over the other's job. The atmosphere, however, was artificial. Economic and sociological laws had been abrogated. The restraints of cost and time, usually the first worry of an engineer, had been removed. Without these restraints any good scientist can make a passable engineer. Engineers were downgraded to mere slide-rule pushers (which, after all, can be done better on an IBM machine). The applied physicist became the big man, forgetting that engineers also apply economics and a few other sciences.

What can be done about it? The answer as you say is education. We must make clear to the public that there is a fundamental difference between the scientist and the engineer and each requires a different course of education. There should be a different degree so that the public will recognize them. To extend the metaphor, we still need reservoirs of scientific knowledge and scientists to fill them. And we need engineers to design pipelines and build the distribution system so that we can benefit from the use of this new knowledge.

Lyman C. Josephs.[6]

**To the Editor:**

Two items in the June issue of MECHANICAL ENGINEERING are of particular interest to me. Mr. Sporn's "The Case for the Engineer" is most timely and important and should be required reading for all engineers and scientists alike.

The news item on page 111 telling of the visit of nine automatic control engineers from American universities is ruined by its title, "Scientists Tour Japan," and the use of scientist in the text. Obviously these men are engineers, not scientists, and should be so designated. If an engineering journal confuses the use of the terms engineer and scientist, we can expect no better from the press-at-large.

Warren E. Wilson.[7]

[5] Consulting engineer, Stamford, Conn. Mem. ASME.

[6] Chief engineer, Auto Division, Ordnance Research and Development Center, Aberdeen Proving Ground, Md. Mem. ASME.

[7] Chairman, Department of Engineering, Harvey Mudd College, Claremont, Calif. Mem. ASME.

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# REVIEWS OF BOOKS

## Project Mohole

### A Hole in the Bottom of the Sea

By Willard Bascom. Doubleday & Company, Inc., Garden City, N. Y., 1961. Cloth, 5 1/2 × 9 in., illus. tables, index, pp. 352, $4.95.

**Reviewed by H. Norman Abramson[1]**

THIS is a fascinating book! In describing the background of AMSOC project for drilling a hole through the earth's crust to the Mohorovicic discontinuity, the author gives a lucid and intriguing glimpse into the entire realm of geophysics. Preceding discussions of geology, gravitation, seismology, oceanography, magnetism, and meteorites, there is a short chapter concerning science-fiction speculation regarding the interior of the earth. Through all of these discussions runs the thread of the Mohorovicic discontinuity, that thin layer of transition between the earth's crust and the mantle, tied together with discussions of its implications throughout all of the various geophysical topics. At the end of this stage of the book, the reader cannot help but be enthused about the scientific knowledge to be gained from physical inspection of samples of the earth's mantle to be gained by drilling a hole through the Moho.

The second half of the book is directed specifically to the problem of drilling a hole (Mohole) through the earth's crust, including discussions of modern oil-well drilling techniques, both onshore and offshore, and a fascinating account of the proposed deep-sea drilling platform for the AMSOC project.

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Not the least interesting portions of this book are those which describe the background, both political and scientific, which led through to the formation of the American Miscellaneous Society and the establishment of the AMSOC Committee under the National Academy of Sciences—National Research Council.

Anyone interested in any phase of the earth's sciences and related engineering problems will find the reading of this book to be a most pleasurable and enlightening experience.

## BOOKS RECEIVED IN LIBRARY

**Tables for Petroleum Gas/Oxygen Flames**

By I. I. Berenblut and Ann B. Downes. 1960, Oxford University Press, New York, N. Y. 107 p., $5^3/_4 \times 8^3/_4$ in., bound. $4.80. This book presents in tables the theoretical equilibrium composition and thermodynamic properties of the combustion products of rich liquified petroleum gas/oxygen flames. The calculations of the results tabled here take into account dissociation of the gases into all possible components.

**ASTM Standards on Petroleum Products and Lubricants, 37th Edition**

Published 1960 by the American Society for Testing Materials, Philadelphia, Pa. 113 p., $6^1/_4 \times 9^1/_4$ in., bound. $9.50. Includes 168 standards of which some 31 are new, revised, or have had their status changed since the 1959 edition. The 1960 edition is being issued in two volumes. Volume one contains most of the ASTM Standards on petroleum, including crude petroleum, butadiene, motor and aviation fuels, naphthas, diesel fuels, lubricating, cutting, industrial, turbine and spray oils, greases, waxes, and related materials. Volume two will contain related standards used in the petroleum industry.

**ASTM Specifications for Steel Piping Materials, 17th Edition**

Published 1960 by the American Society for Testing Materials, Philadelphia, Pa. 523 p., $6^1/_4 \times 9^1/_4$ in., bound. $7. Includes more than 90 specifications, more than half of them revised since the 1959 edition. They cover pipe used to convey liquids, vapors, and gases at normal and elevated temperatures, still pipes for refinery service, heat-exchanger and condenser tubes, boiler, superheater and economizer tubes, and the castings, forgings, bolting, and welding fittings used in such installations.

**Aeronautics and Astronautics**

Edited by Nicholas John Hoff and Walter Guido Vincenti. 1960, Pergamon Press, New York, N. Y. 460 p., $6^1/_4 \times 9^1/_4$ in., bound. $12. The Proceedings of a conference held at Stanford University, Aug. 5–9, 1959, in honor of the 100th anniversary of the birth of William Frederick Durand, and sponsored by the ASME, the IAS, and several U. S. Government research organizations. Four papers are devoted to the life and career of Durand, and to his contributions to aeronautics. The remaining 18 papers discuss various aspects of the conference subjects, such as similarity solutions of hydrodynamic problems, flight-structures design, space structures, theories of buckling of thin cylindrical shells, mechanics of rarefied gases, effusive flow, transition, atmosphere re-entry problems, radar astronomy, creep buckling of plane frameworks, thermodynamic foundations of the theory of deformation, plasma and particle dynamics, and heat transfer in hypersonic flow.

**Bergman's Linear Integral Operator Method in the Theory of Compressible Fluid Flow**

By M. Z. v.Krzywoblocki. 1960, Springer-Verlag, Vienna, Austria. 188 p., $8 \times 10^3/_4$ in., bound. $12.40. The purpose of this work is to represent Bergman's method in all its variations in such a way that it can be used in practical applications by engineers. The emphasis is on simplified representation of the final results and formulas, rather than the derivation and mathematical proofs of those formulas, and the discussion is admitted to be too elementary for the mathematician. Parts 1–5 are based on Bergman's original papers, and cover subsonic, supersonic, transonic, and axially symmetric flow. Part 6 describes singularities as related to hodographic transformations, and part 7 contains a review of other methods in the theory of compressible fluid flow. The remaining eight sections contain tables, examples, general remarks and errata, as well as discussion of generalization to diabatic flow and three-dimensional flow, and some computations using Bergman's method and carried out on the U. S. National Bureau of Standards Eastern Automatic Computer.

**Beulwerte Ausgestreifter Rechteckplatten**

By Kurt Klöppel and Joachim Scheer. 1960, Wilhelm Ernst & Sohn, Berlin, Germany. 107 p., $9 \times 12^1/_2$ in., bound. DM 48.00. A study on buckling values for stiffened rectangular plates, with tables and diagrams for ready reference on the buckling strength of variously stiffened arrangements and loads.

**Classical Mechanics**

By H. C. Corben and Philip Stehle. Second Edition. 1960, John Wiley & Sons, Inc., New York, N. Y. 389 p., $6 \times 9^1/_4$ in., bound. $12. This book describes "classical mechanics"—the theory of the motion of particles under conditions in which Heisenberg's uncertainty principle has essentially no effect on the motion, and therefore may be neglected. It is the mechanics of Newton, Lagrange, Hamilton, and Einstein. The book is intended to show the underlying assumptions and the boundaries beyond which its uncritical extension is dangerous, and to smooth the transition to quantum and relativistic mechanics. This second edition includes new material and revisions, particularly in applications to such problems as the theory of space-charge limited currents, atmospheric drag, rocket motions, transfer functions, the motion of meteoric dust, dissipative systems, spin motion, rotating co-ordinate systems, non-central forces, the inverted pendulum, and the motion of particles in high-energy accelerators.

**Elements of Flight Propulsion**

By J. V. Foa. 1960, John Wiley & Sons, Inc., New York, N. Y. 445 p., $6 \times 9^1/_4$ in., bound. $12.50. Written for students and practicing engineers, this book is used in undergraduate and first-year graduate courses, and requires a working knowledge of elementary calculus. It gives equal attention to both steady and nonsteady propulsive flows, and is concerned more with broad views than rigorous analytical treatment. Specific classes of thrust generators are discussed merely as illustrations of general methods and ideas, in the final two chapters. The earlier chapters discuss basic laws and concepts, one-dimensional approximations, one-dimensional steady and nonsteady flow, nonuniform flows, diffusers, nozzles, dynamic flow machines, pressure exchange, combustion chambers, thrust, and drag.

**Elements of Maser Theory**

By Arthur A. Vuylsteke. 1960, D. Van Nostrand Company, Inc., Princeton, N. J. 362 p., $6^1/_4 \times 9^1/_4$ in., bound. $9.50. This is a basic guide to fundamental maser theory. Part one contains a brief description of the Bohr quantum theory and of statistical mechanics, forming a relatively complete though superficial survey of the basic phenomena responsible for maser behavior. Part two (chapters 2-4) presents as much of the theory of quantum mechanics, statistical mechanics, and radiation theory as the author believes necessary for the understanding of the last section of the book, which is concerned directly with masers. In part three (chapters 5-8) is found a theoretical treatment of the most basic and currently well-understood features of masers, omitting discussion of research in progress and such developments as optical and infrared masers.

**Energy in the American Economy, 1850–1975**

By Sam H. Schurr and Bruce C. Netschert. 1960, The Johns Hopkins Press, Baltimore, Md. 774 p., $6^3/_4 \times 10$ in., bound. $12.50. A survey publication of Resources for the Future, Inc., which examines the sources, supply, and use of energy in the U. S. A. during the years 1850–1975, their place in the economic development of the country, and the future energy picture. Reversing the usual procedure, projections of the future are considered first, in the introductory section, which summarizes and evaluates the findings and conclusions of the other three sections of the book, and on this basis discusses the future. Part 1 then presents an historical analysis of the statistical record of energy supply and demand in the U. S. A. over the past 100 years, an analysis which shows large increase in the total amount of energy used, and significant shifts in supplying the growing needs. Part 2 and 3 evaluate the future energy position of the U. S. A., both in terms of the country's growing needs, and of its ability to satisfy them from domestic resources. Extensive tables and graphs make this an excellent statistical source book in the energy field.

**The Extrusion of Metals**

By Claude E. Pearson and Redvers N. Parkins. Second Edition. 1960, John Wiley & Sons, Inc., New York, N. Y. 336 p., $5^1/_2 \times 8^3/_4$ in. bound. $7.50. This is a thoroughly updated edition of the 1944 (and later reprinted) presentation of extrusion practice relating to different classes of work and materials. The authors have added over 100 pages, including a completely new chapter on an evolved theory of flow which is seen as a valuable guide to industrial practice. New bibliographical references are also included. Recent trends and processes are discussed, but the emphasis is still on basic principles, accompanied by brief historical background information and attention to theoretical aspects.

**Impact**

By Werner Goldsmith. 1960, St. Martin's

Press, Inc., New York, N. Y. 379 p., 6¼ × 9¼ in., bound. $17.50. Based on the author's lectures at the University of California, this book summarizes the more important contributions to the theory of impact. Intended as a reference source or advanced text in applied mechanics, and some areas of applied mathematics and physics, it requires knowledge of partial differential equations, operational calculus, and elasticity. The first chapter describes the nature of physical impact and gives a brief history of the study of impact phenomena. Chapters 2-5 discuss the dynamics of impact, employing mathematical analyses in the process. Lack of space prevents inclusion of complete derivation of some of the analytic relations, but extensive references are given to pertinent sources. Chapter six contains the results of experiments designed to substantiate various theories of impact, and the final chapter describes the behavior of materials under conditions of dynamic loading.

**International Association for Bridge and Structural Engineering, Sixth Congress, 1960**

1960, Verlag Leemann, Zurich, Switzerland. 928 p., 7 × 9¾ in., bound. SF 70. This volume includes over 50 selected papers by authors from the U. S. A., Europe, and the USSR. The five themes covered, each introduced by a general report, are (1) the basis of structural design, (2) metal structures, (3) steel skeletons, (4) bridge building and, (5) prefabricated structures. A sixth section presents new developments in bridge and constructional engineering and includes a paper on nuclear-power stations and one on nuclear-reactor structures. Papers are in English, French, or German, with the general reports and summaries of the papers in all three languages.

**Top Management Handbook**

Edited by H. B. Maynard. 1960, McGraw-Hill Book Company, Inc., New York, N. Y. 1236 p., 6¼ × 9¼ in., bound. $17.50. This comprehensive collection of chapters written by top managers, carefully selected to represent a cross section of type and size of industry and plant, presents authoritative discussions of each facet of the task of managing, written from the standpoint of personal experience. The nature of the task is emphasized, and such elements as gathering information, directing, guiding and leading, evaluating and measuring results, promoting innovation, managing the research and development activity, managing the marketing activity, and building and retaining top management, are covered. The book includes short biographical sketches of the authors, and will be of interest to managers, management students, and to those interested in the thoughts and activities of the leaders of industry.

**Manipulation of Thermoplastic Sheet, Rod and Tube**

By J. M. Estevez and D. C. Powell. 1960, Interscience Publishers, Inc., New York, N. Y. 148 p., 5⅜ × 8¾ in., bound. $4.85. Written primarily for students, this British text treats fully thermoplastic materials with the exclusion of those based on cellulose or casein, and does not include consideration of thin sheet, specialized uses of sheet, and block material. Thus limiting its scope for the sake of brevity, and thoroughness of treatment for the remaining materials, the discussion is detailed concerning machining, decorating, cementing and welding, the theory of heat forming, and shaping by heat, air, and mechanically applied pressure, and by vacuum. The final chapters deal with complex processes using a plurality of methods, tool construction and design, the vacuum forming machine, and special topics such as veneering and biaxial stretching.

**Mollier-Diagramme Für Verbrennungsgase, Part 1**

By Walter Pflaum. Second Edition. 1960, VDI-Verlag GmbH, Düsseldorf, Germany. 23 p., 8¼ × 11¾ in., paper. DM 67.00. An explanatory text on Mollier diagrams for combustion gases with examples of application and general preliminary calculations for combustion engines. The topics include basic principles, numerical calculations, the basic Mollier diagrams, and auxillary diagrams. A group of large folded diagrams for different air conditions accompanies the explanatory text.

# ASME BOILER AND PRESSURE VESSEL CODE

## Interpretations

THE Boiler and Pressure Vessel Committee meets regularly to consider "Cases" where users have found difficulty in interpreting the Code. These pass through the following procedure: (1) Inquiries are submitted by letter to the Secretary of the Boiler and Pressure Vessel Committee, ASME, 345 East 47th Street, New York 17, N. Y.; (2) Copies are distributed to Committee members for study; (3) At the next Committee meeting interpretations are formulated to be submitted to the ASME Board on Codes and Standards, authorized by the Council of the Society to pass upon them; (4) They are submitted to the Board for action; (5) Those which are approved are sent to the inquirers and are published in MECHANICAL ENGINEERING.

(The following Case Interpretations were formulated at the Committee meeting April 28, 1961, and approved by the board on June 30, 1961.)

**Case 1272N-3**
***(Special Ruling)***
**Containment and Intermediate Containment Vessels**

Revise Par. (1) (d) of the Reply to read:

(1) (d) All welds on doors, nozzles, and opening frames shall meet the detail requirements in Figs. UW-16.1, UA-6, UG-34, and/or UA-48 as they apply and all welds that cannot be radiographed shall be examined for cracks by magnetic particle or by fluid penetrant or by ultrasonic method of inspection.

Add Pars. (5) (f) and (5) (g) to the Reply as follows:

(f) Secondary stresses,* such as, for example, those which occur at changes in geometry of the structure or are produced by thermal gradients within the structure, shall be calculated on the assumption of elastic behavior, combined with the stresses calculated in accordance with Par. (5) (g) following, and the sum of such stresses shall be limited to three times the allowable stress values given in Table UCS-23.

(g) Primary stresses,** such as, for example, those which are produced by weight, pipe loads, wind, snow, or specified live loads, shall be combined with the primary stresses calculated by the formulas of Section VIII, and the sum of such stresses shall be limited for design conditions on final supports as follows:

1 General membrane stresses to 1.1 times the allowable stress values given in Tables UCS-23.

2 Combined general membrane, general bending, and local membrane stresses to 1.5 times the general membrane stress values permitted by (5) (g) (1).

* Secondary stress, for the purposes of this Case, shall be defined as a stress developed by the constraint of adjacent parts or by self-constraint of a structure. The basic characteristic of a secondary stress is that it is self-limiting; local yielding or minor distortions can satisfy the conditions which cause the stress to occur, and failure from one application of the stress is not to be expected. Examples of secondary stresses are: (1) Discontinuity stress in the longitudinal direction at a head-to-shell or nozzle-to-shell junction, and (2) All thermal stresses acting on a shell except the effect of forces and moments produced by expansion of connected piping system.

** Primary stress, for the purpose of this Case, shall be defined as a stress developed by the imposed loading which is necessary to satisfy the laws of equilibrium of external and internal forces and moments. The basic characteristic of a primary stress is that it is not self-limiting and therefore a primary stress which exceeds the yield strength may result in failure or gross distortion. Examples of primary stresses are (1) General membrane stress in a shell produced by internal pressure or distributed live loads, and (2) Local membrane stresses in a shell produced by the external load and moment at a permanent support or nozzle neck, and (3) Local membrane stresses acting circumferentially at points of discontinuity, such as head-to-shell or nozzle-to-shell junctions.

**Case 1276N**

*(Special Ruling)*

**Special Equipment Requirements**

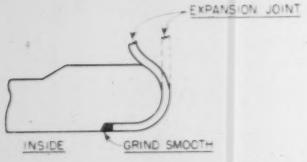
*Inquiry:* May expansion joints meeting the requirements of Case 1177 be used on the secondary side of primary vessels intended for nuclear service, and if so, how shall they be attached to the vessel?

*Reply:* It is the opinion of the Committee that expansion joints may be used on the secondary side of primary vessels as well as on the secondary vessels, if bellows type expansion joints meeting the requirements of Case 1177 are used and providing the following two additional requirements are met:

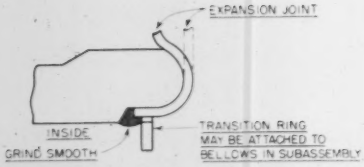
(1) All welded joints in the bellows portion of the expansion joint are of the double welded butt type as defined in Par. 3 of Case 1270N.

(2) The bellows portion of the expansion joint is attached to the vessel nozzle or juncture by circumferential welds of a butt type having full fusion and penetration through the thickness of the bellows portion as exemplified by Sketches 1 and 2. Following the completion of the butt type weld it shall be magnetic particle tested when a ferritic weld is made, or fluid penetrant tested when an austenitic weld is made. In addition, the joint shall pass a Halide leak detector test.

In the present state of the art and pending further development in the design and testing of expansion joints, it is the opinion of the Committee that expansion joints shall not be used in the main shell and heads of nuclear reactor vessels and primary vessels.




SKETCH 1




SKETCH 2

**Case 1295**

*(Special Ruling)*

**Permission to Use 19-9DL Alloy Bolting**

*Inquiry:* May bolting, including studs and nuts, made of material of the composition listed below be used in the construction of boilers and unfired pressure vessels in accordance with the ASME Boiler and Pressure Vessel Code for temperatures up to 1000 F, inclusive?

| | | Check Analysis Under Min | Over Max |
|---|---|---|---|
| Carbon | 0.28–0.35 | 0.02 | 0.02 |
| Manganese | 0.75–1.50 | 0.04 | 0.04 |
| Silicon | 0.30–0.80 | 0.05 | 0.05 |
| Phosphorus | 0.040 max | | 0.005 |
| Sulphur | 0.030 max | | 0.005 |
| Chromium | 18.00–21.00 | 0.25 | 0.25 |
| Nickel | 8.00–11.00 | 0.15 | 0.15 |
| Molybdenum | 1.00–1.75 | 0.05 | 0.05 |
| Tungsten | 1.00–1.75 | 0.05 | 0.05 |
| Columbium-Tantalum | 0.25–0.60 | 0.05 | 0.05 |
| Titanium | 0.10–0.35 | 0.00 | 0.05 |
| Copper | 0.05 max | | 0.03 |

*Reply:* It is the opinion of the Committee that material of the composition listed in the inquiry may be used in the form of bolting, including studs and nuts, for Code construction, with the following requirements and restrictions:

1 The bolting shall conform to the general requirements of Specifications SA-193 and SA-194 where applicable except as modified by the above chemical requirements and as in the following:

2 The product shall be heat-treated using the following methods:

(*a*) Hot-cold worked with final working done at a temperature not lower than 1400 F and stress relieved at not lower than 1200 F ± 50 F for not less than four hours.

3 Bolting to Specification SA-193 shall meet the following mechanical properties:

| | |
|---|---|
| Tensile Strength, psi | 100,000 min |
| Yield Strength at 0.2% offset or at 0.0088 in. in 2 in. extension under load, psi | 60,000 min |
| Elongation, % in 4D | 20 min |
| Reduction of Area, % | 40 min |
| Hardness, Brinell | 228–277 |

4 Nuts to Specification SA-194 shall have a hardness as shown.

5 The maximum allowable stress values shall be as follows:

| Temp F | Stress Psi |
|---|---|
| −20 to 100 | 20,000 |
| 200 | 18,400 |
| 300 | 16,800 |
| 400 | 16,800 |
| 500 | 16,500 |
| 600 | 16,150 |
| 700 | 15,950 |
| 800 | 15,750 |
| 900 | 15,600 |
| 1000 | 15,200 |

**Case 1296**

*(Special Ruling)*

**Permission to Use A 286 Alloy Bolting**

*Inquiry:* May bolting, including studs and nuts, made of material of the composition listed below be used in the construction of boilers and unfired pressure vessels in accordance with the ASME Boiler and Pressure Vessel Code for temperatures up to 1000 F inclusive?

| | | Check Analysis Under Min | Over Max |
|---|---|---|---|
| Carbon | 0.08 max | | 0.01 |
| Manganese | 1.00–2.00 | 0.04 | 0.04 |
| Silicon | 0.40–1.00 | 0.05 | 0.05 |
| Phosphorous | 0.040 max | | 0.005 |
| Sulphur | 0.030 max | | 0.005 |
| Chromium | 13.50–16.00 | 0.20 | 0.20 |
| Nickel | 24.00–24.00 | 0.20 | 0.20 |
| Molybdenum | 1.00–1.50 | 0.05 | 0.05 |
| Titanium | 1.90–2.30 | 0.05 | 0.05 |
| Boron | 0.0010–0.010 | 0.0004 | 0.001 |
| Vanadium | 0.10–0.50 | 0.03 | 0.03 |
| Aluminum | 0.35 max | | 0.05 |

*Reply:* It is the opinion of the Committee that material of the composition listed in the inquiry may be used in the form of bolting, including studs and nuts, for Code constructions with the following requirements and restrictions:

1 The bolting shall conform to the general requirements of Specifications SA-193 and SA-194 where applicable except as modified by the above chemical requirements and as in the following:

2 The product shall be heat-treated using either of the following methods:

(*a*) Solution heat-treated at 1800 F ± 25 F holding at heat for one hour and quenching in oil or water. The material should then be aged at temperatures less than 1400 F preferably 1,325 F ± 15 F for 16 hours and air cooled to room temperature.

(*b*) Solution heat-treated at 1650 F ± 25 F holding at heat for one hour and quenching in oil or water. The material should then be aged at temperatures less than 1400 F preferably 1325 F ± 15 F for 16 hours and air cooled to room temperature.

3 Bolting to Specifications SA-193 shall meet the following mechanical properties:

| | |
|---|---|
| Tensile Strength, psi | 130,000 min |
| Yield Strength at 0.2% offset or at 0.0098 in. in 2 in. extension under load (E = 29,100,000), psi | 85,000 min |
| Elongation, % in 4D | 15 min |
| Reduction of Area, % | 18 min |
| Hardness, Brinell | 248–341 |

4 Nuts to Specification SA-194 shall have a hardness as shown.

5 The maximum allowable stress values shall be as follows:

| Temp F | Stress, Psi |
|---|---|
| −20 to 100 | 20,000 |
| 200 | 20,000 |
| 300 | 20,000 |
| 400 | 20,000 |
| 500 | 20,000 |
| 600 | 20,000 |
| 700 | 20,000 |
| 800 | 20,000 |
| 900 | 20,000 |
| 1000 | 20,000 |

## Proposed Revisions and Addenda to Boiler and Pressure Vessel Code . . .

As NEED arises, the Boiler and Pressure Vessel Committee entertains suggestions for revising its Code. Revisions approved by the Committee are published here as proposed addenda to the Code to invite criticism. If and as finally approved by the ASME Board on Codes and Standards, and formally adopted by the Council, they are printed in the semi-annual addenda supplements to the Code. Triennially the addenda are incorporated into a new edition of the Code.

In the following the paragraph numbers indicate where the proposed revisions would apply in the various sections of the Code.

### Power Boilers, 1959

TABLE P-7 Revise as follows:

Table P-7; delete Note (13) after the plate materials SA-387, Grades A, B, C, D, and E and after pipe material SA-335, Grade P5c.

FIG. P-21 Revised

Copy of the proposed revised figure may be obtained from the Secretary of the ASME Boiler and Pressure Vessel Committee, 345 East 47th Street, New York 17, N. Y.

PAR. P-105(a) Revise to read as follows:

Longitudinal, circumferential, and other joints uniting the materials of the drum, shell, nozzle, or other pressure parts, except as provided in Pars. P-112, P-114, P-186, P-198, P-268, P-299, and P-300 shall be of the double welded type and shall be . . .etc.

PAR. P-105(a) Delete the word "*butt*" in the 9th and 10th lines.

PAR. P-112(c) Revise last parenthetical statement to read:

"(See Pars. P-299 and P-300 for slip on flanges.)"

PAR. P-198 Revised

Copy of the proposed revision may be obtained from the Secretary of the Boiler and Pressure Vessel Committee, 345 East 47th Street, New York 17, N. Y.

PAR. P-291 Revise to read as follows:

PAR. P-291(a)

Water Glasses. Each boiler shall have at least one water-gage glass except that boilers operated at pressures over 400 psi shall be provided with two water-gage glasses which may be connected to a single water column or connected directly to the drum. Two independent remote level indicators may be used instead of one of the two required gage glasses for boiler drum water-level indication in the case of power boilers with all drum safety valves set at or above 900 psi. When both remote level indicators are in reliable operation, the gage glass may be shut off but shall be maintained in servicable condition.

When the direct reading of gage glass water level is not readily visible to the operator in his working area, two dependable indirect indications shall be provided, either by transmission of the gage glass image or by remote level indicators.

The lowest visible part of the water-gage glass shall be at least 2 in. above the lowest permissible water level, which level shall be that of which there will be no danger of overheating any part of the boiler when in operation at that level. When remote level indication is provided for the operator in lieu of the gage glass, the same minimum level reference shall be clearly marked.

Boilers of the horizontal fire-tube type shall be so set that when the water is at the lowest reading in the water-gage glass, there shall be at least 3 in. of water over the highest point of the tubes, flues or crown sheets.

The gage glass connections and pipe connections shall be not less than $\frac{1}{2}$ in. pipe size. Each water-gage glass shall be fitted with a drain cock or valve. When the boiler operating pressure exceeds 100 psi, the glass shall be fitted with a globe or gate-valved drain to the ash-pit or other safe discharge point.

Connections between the remote level indicator and the drum shall comply with paragraphs P-293 and P-320 for water columns and shall be completely independent of connections for any function other than water-level indication.

PAR. P-299(f) Delete this paragraph.

PAR. P-299(k) Add the following to Par. P-299(k)

American Standard slip-on flanges not exceeding 4" nominal pipe size may be attached to piping or boiler nozzles by double fillet welds provided the throats of the fillet welds are not less than 0.7 times the thickness of the part to which the flange is attached. American Standard socket welded flanges may be used in piping or boiler nozzles provided the dimensions do not exceed 3 in. nominal pipe size for 600 psi and lower classes, and $2\frac{1}{2}$ in. in the 900 and 1500 classes.

PAR. P-350 Add new paragraph and make corresponding Editorial Revisions in Code. Copy of these proposed revisions may be obtained from the Secretary of the ASME Boiler and Pressure Vessel Committee, 345 East 47th Street, New York 17, N. Y.

### Material Specifications, 1959

The Boiler and Pressure Vessel Committee approved the insertion of a sheet before the SB Specifications in Section II indicating the ASA grade designations for aluminum materials as the primary designations and the ASTM designations as the secondary ones.

### Boilers of Locomotives, 1959

This Section of the Code has been dropped since all rules for Boilers of Locomotives are now included in Section I, Power Boilers.

### Unfired Pressure Vessels, 1959

Revise Section VIII to assign the ASA grade designations for aluminum materials as primary designations and the ASTM designations as secondary.

PAR. UG-34 Revised. (Copy of the proposed revision may be obtained from the Secretary of the ASME Boiler and Pressure Vessel Committee, 345 East 47th Street, New York 17, N. Y.)

FIG. UG-34 (f), (k), & (l) Copy of the proposed revised figure may be obtained from the Secretary of the ASME Boiler and Pressure Vessel Committee, 345 East 47th Street, New York 17, N. Y.

PAR. UCS-56(b) (3) Revise to read:

"The thickness of the shell in connections to tube sheets, flat heads, covers, or similar constructions."

PAR. UG-85 Add new Par. UG-85 to read:

PAR. UG-85 **Heat-Treatment**

When the material specification requires a normalizing heat-treatment for the purpose of grain refinement and this heat-treatment is performed by the vessel fabricator, he shall demonstrate to the inspector that the requirements of the specification have been met in accordance with a written procedure. The heat-treatment carried out shall be in substantial agreement with that performed by the plate manufacturer on the test specimens.

APPENDIX II

Revised (Copy of the proposed revision may be obtained from the Secretary of the ASME Boiler and Pressure Vessel Committee, 345 East 47th Street, New York 17, N. Y.)

Current Engineering: Events, News, and Comment

E. S. NEWMAN
News Editor

# THE ROUNDUP

## Engineering and World Affairs Theme of ASEE Meeting

ENGINEERING educators, 3000 strong, attending the 1961 annual meeting of the American Society for Engineering Education at the University of Kentucky in Lexington, June 26 to 30, were told to "accept the responsibilities which the interdependence of nations have brought to your doorstep."

"As engineers, you and your students must take your fair share of the responsibility for the changes—political, economic, and social—which are taking place with such tremendous speed, since clearly modern technology has been a contributing factor," Dr. Myer Cohen, director of operations for the United Nations Special Fund, told a banquet audience.

His remarks keynoted the theme of the meeting: "Engineering and World Affairs."

Dr. Eric A. Walker, president of the Society and of Pennsylvania State University, in an opening statement, called on engineering educators to accept their international obligations:

"Half the world is ill-fed, ill-housed, and ill-clothed. To eliminate these conditions is an engineering job for engineers. Can we in America's engineering colleges train 5000 students who will work and sacrifice and so do something truly important for humanity—and do it with such skill and dedication that the rest of us can also be called professional men?"

**The Challenge.** In his presidential address Dr. Walker continued his challenge:

"We are living in what should be for engineers the most exciting period in history. There are important things to be done; society needs engineers and their talents more than it has needed them in any other period in history. This work will not be done by young engineering graduates oriented in their classes to look no further than a job of designing unnecessary fins for automobiles. For this we need young engineers with ideas, imagination, vision, idealism, and courage. And we need young engineering teachers who can inspire and encourage these ideas."

The key position of engineering educators in meeting these needs was emphasized by Dr. Cohen. But, he said, the problems are not simply solved. "The job," he declared, "requires a good deal more than technical know-how; it involves training, adapting, and inspiring. It requires a knowledge of psychology and anthropology, an intuitive ability to appreciate the folkways and mores of people having an outlook on life and daily habits totally different from ours."

Members of ASEE's Humanities and Social Sciences Division heard this theme repeated at many of their sessions. Two of their members, William F. Edington of General Motors Institute and Baird W. Whitlock of Case Institute of Technology, wrote, "If our graduates are to correct any prevalent images of the 'ugly American,' if they are to set examples for constructive leadership at local and international levels, they must develop a deep understanding of human behavior, a knowledge of various cultures, a broad historical perspective, a sense of social purpose, greater abilities to communicate with diverse peoples, and a real comprehension of this and other social and political systems. Otherwise, they may fail dangerously not only as professional men but as ambassadors for human welfare, both at home and abroad."

**Teaching Foreign Students.** Problems of teaching foreign students in the United States were reviewed at a number of sessions, and the unanimous conclusion was one of uncertainty. Students from underdeveloped countries studying in most American engineering colleges become proficient in subjects at the frontiers of engineering science, but they may not find outlets for these new talents in their own countries struggling with basic problems of industrialization and the use of natural resources. Dean Kurt F. Wendt of the University of Wisconsin suggested an internship program for foreign students to give them practical experience in American industry. And Dean Fred H. Pumphrey of Auburn University said that in his experience foreign students also wanted special classes in the cultural, religious, and social backgrounds of American life.

But the challenge was clear: "Can the American Society for Engineering Education have a more important project than the education and guidance of young foreign engineers who are being courted by the Communists?" asked Felix E. Larkin, executive vice-president of W. R. Grace and Company. "I can think of no group that can thus help in the world-wide fight for freedom as well as this association," he declared.

**Technological Sophistication—Yes or No.** Research and development managers want their future employees—today's engineering students—to be educated for "new levels of technological sophistication" and to keep pace with subjects which are being "dramatically transformed" by new scientific and engineering discoveries.

But more than half of today's engineering students go into operation and production, and their future bosses insist that they must understand the "practical and economic factors" in traditional engineering.

These sharply contrasting views—the dilemma of modern engineering education—were debated by three representatives of industry asked to comment on the effectiveness of engineering schools today as preparation for engineers entering their fields of work.

Speaking of the needs in research organizations, Winston E. Kock, director

of research laboratories for the Bendix Corporation, said today's engineering graduates must be brought "to a greater level of technological sophistication." They must understand modern nuclear physics and computer technology, which have made developments almost in the forefront of science obsolete "almost overnight."

"The material in engineering courses must be constantly revised in these rapidly moving fields of technology," he said.

Joseph F. Skelly of the M. W. Kellogg Company agreed. He said that the most important need is to give students an undergraduate education "which develops in them a willingness to accept change." They must be prepared to continue their technical education "more or less continuously during their entire working careers in research and design."

In contrast, R. J. Short, Mem. ASME, of the Procter and Gamble Company stressed that more than half of today's graduates will build and operate increasingly complex industrial plants. "Today we share the concerns of many who fear that we may be neglecting the needs of the graduates who must design and build and operate our industries," he said. The practical, economic, and human factors—not so much the theoretical ones—are essential, he said, and "our balance in these matters must be influenced by the needs and wishes of our industrial system."

While calling for a return to practical fundamentals of engineering, Mr. Short suggested that these could lead toward a unification of engineering curriculums. "In operations and production," he told the engineering educators, "we soon lost track of whether a man's initial training was in electrical, mechanical, or civil engineering."

**Telephones With Screens.** Computers that converse with one another and telephones with screens which provide "a better picture than we can imagine" were forecast by W.K. Lowry, manager of technical information libraries at the Bell Telephone Laboratories, Murray Hill, N. J. He gave engineering school librarians these forecasts of tomorrow's communication systems:

1 Computers do communicate with each other and are doing so at an ever-increasing rate. "In the future there will be as much information transmitted by computers over telephone circuits as there now is between people."

2 Telephones with picture screens will permit merchants to call customers and display their wares; children to visit art galleries by telephone; and businessmen to do all their office work from a study at home, in constant communication with their colleagues, each in his own home.

What will make these great achievements possible? "Engineers," said Mr. Lowry, "must learn to communicate with people who are not engineers," and librarians must provide vastly faster and more efficient processing of the increasing flow of new information in the literature. Specially trained librarians will be needed, he said.

**Spotlight Picks Out Other Topics.** Other topics which received major attention during the ASEE meeting included these:

1 The conflict between the traditional concepts of engineering education and the new emphasis on the engineering sciences continues. Prof. Newman A. Hall, Mem. ASME, of Yale University admitted that students emerging from the new programs may not be adquately prepared for "the team effort which the profession of engineering must represent." And another dissenting view came from Prof. Lawrence E. Fouraker of the Pennsylvania State University, who speculated that "there are some indications that the engineer is running into diminishing returns in the application of science to the problems of production. There are few virgin stretches of science left for the pragmatist to exploit," he said, "and the time will soon be upon us when substantial innovations in technology will be conditional upon comparable innovations in the underlying sciences."

2 A report released by ASEE's Nuclear Engineering Committee in association with the American Nuclear Society recommended that "the primary responsibility for formal, specialized education of nuclear engineers lies at the graduate level. Only under unusual circumstances," said the report, "can programs leading to the baccalaureate degrees in nuclear engineering provide both the breadth and depth required."

3 ASEE's Engineering College Research Council announced survey results showing that over 11,000 research projects, with budgets totaling over $180 million annually, are now in progress on American engineering school campuses. More than 16,000 teachers and their graduate students are devoting part time to this work. Merl Baker, director of the University of Kentucky Research Foundation, said that every engineering faculty should be giving at least half its total effort to research of high caliber.

4 Research on the teaching of engineering received impetus at many sessions of the five-day meeting. Calling attention to the "period of explosive expansion" to come in engineering colleges, Harold Foecke of Notre Dame University advocated establishment by the Society of a Center for Engineering Education, to help colleges exploit new methods and new equipment.

## EDUCATION

### Network Analyzer Is Teaching Tool

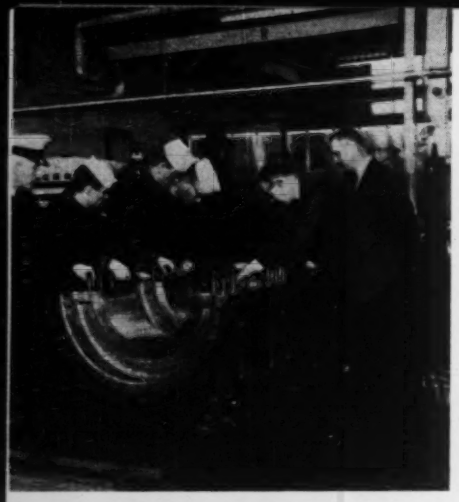
VIRGINIA POLYTECHNIC INSTITUTE now has the use of an A. C. network analyzer deeded to it by the American Electric Power Service Corp. Installed ten years ago in the company's engineering office in New York City, at an original cost of $250,000, the analyzer was used to plan much of the 10,000 miles of 345 and 132-kv high voltage and area subtransmission serving the seven-state American Electric Power System.

Philip Sporn, Hon. Mem. ASME, president of AEP, said that "the analyzer has been invaluable in the past in planning future transmission requirements and solving many complex operating problems and remains, today, a valuable teaching tool."

### Industry and Education

● NEWARK College of Engineering recently put its new Computer Center into operation. The center consists of an IBM 1620 computer—believed to be the first of its kind among colleges and universities in New Jersey—and paper-tape apparatus. Later this year, it will be outfitted for card-punch operations.

Frederick G. Lehman, newly appointed director of the center, said that every NCE undergraduate would be introduced to its operations, and that next fall, instruction would be given to more than 1000 day-session students and to others in the graduate and special courses evening divisions. Operating 11 hours a day, five days a week throughout the year, the center plans to provide ample time for data processing by faculty members engaged in research sponsored by the NCE Research Foundation. The center, with a staff of five technicians, also will make its facilities available to



Four naval crewmen from the USS Proteus receive instruction on the operation and service of intricate components designed and manufactured by Zurn Industries, Inc., for use in the U. S. Navy's atomic submarines. They are students at a special school being conducted by Zurn, pioneer in research, design, and manufacture of components for the main propulsion and sound-isolation drive system in atomic submarines. After finishing the course, the men will return to duty aboard the Proteus, a submarine tender, to instruct other Navy personnel.

other educational groups outside the college.

● New York University will have the use of nuclear facilities of the Union Carbide Nuclear Company in Sterling Forest near Tuxedo, N. Y. The announcement is the result of negotiations between the two organizations that began shortly after NYU announced its plans for an educational research community to be located on a site near Union Carbide's research center. Union Carbide's research facilities in Sterling Forest include a five-megawatt pool-type research reactor and its associated radioactive materials laboratory. The NYU center will be located in University Valley, a 1000-acre tract in the heart of Sterling Forest. It will be developed as a complete educational research community with facilities for adult education and graduate study, faculty and student housing, and a scientific program of pure and applied research. Laboratories will be built for research in metallurgy, the engineering sciences, geophysics, medicine, meteorology, nuclear engineering, and public health.

### New Programs

● Under an international education program to begin next year at Union College, Schenectady, N. Y., selected engineering students will spend one year abroad, studying at one of several European technical institutes. The latter may include such institutions as the Eidgenossiche Technische Hochshule in Zurich, Switzerland; the Technische Hochshule in Munich, West Germany; and the University of West Berlin. The program will be open to qualified students now enrolled in the college's five-year combined program both in liberal arts and engineering. The foreign study will be planned for the third or fourth year of the five-year course.

● Columbia University has announced the purchase of a TRIGA Mark II (Training Research and Isotope-production reactor General Atomic), a self-regulating reactor developed by General Dynamics Corporation. The first "critical" nuclear reactor to be installed and operated in New York City, it will be housed in the university's new engineering center, now under construction. The center is adjacent to Pupin Hall, where a small group of scientists first split the atom 22 years ago. The reactor will be used by the faculty and graduate students for training, for broad-scope research activities, and for producing radioisotopes.

● Students entering the Cornell University College of Engineering in fall, 1961, will be enrolled in a new division of basic studies designed to provide them during the first two years with a range of knowledge common to all engineering fields. The purpose of the two-year common program is to familiarize students with the range of professional programs available in the last three years of study in Cornell's five-year engineering curriculum.

● Pennsylvania State University has established an interdisciplinary curriculum leading to the MS and PhD degrees in solid-state technology. The program, established because present-day proficiency in the field must be gained through work in two or more disciplines, will enable candidates to carry out research and course work in the colleges of chemistry and physics, engineering and architecture, mineral industries, or a combination of the three. Candidates for degrees will be accepted beginning with the 1961–1962 school year. Information on the program may be obtained from Dean, The Graduate School, Pennsylvania State University, University Park, Pa.

● Graduate school curriculum at the University of Arizona is expanding for next fall, permitting students to earn the MS degree in two additional fields—materials engineering and systems engineering; and the PhD degree in six additional fields, among them, nuclear engineering.

● A new Engineering Division at Case Institute of Technology replaced the separate departments of civil, electrical, mechanical, and chemical engineering, effective July 1. For administrative purposes, the new division will be considered as two groups—the Engineering Design and Systems Group and the Engineering Science Group. Ray E. Bolz, Mem. ASME, former head of the mechanical-engineering department, is heading the new division while also being responsible for work in engineering sciences. Harry R. Nara, Mem. ASME, head of the former civil-engineering department is associate head of the division with responsibility for work in engineering design and systems.

In announcing the new division, Dr. T. Keith Glennan, president of Case Institute, gave three reasons for the change. He said, "The first is recognition that traditional departmental structure is no longer a valid foundation for the building of an engineering education program to prepare men for responsible positions in industry, government, and education. The second is to substitute for a rigid organization a flexible one able to anticipate swiftly engineering educational requirements. The third, and perhaps most important reason, is that the change in departmental organization provides flexibility of movement for the interests of the student.

"Reorganization of the engineering departments constitutes acknowledgment of the fact that when the engineer embarks upon his professional career, he will not find his problems arbitrarily split between specialized and narrowly defined engineering fields," said Dr. Glennan.

For the present, Case Institute will continue to grant undergraduate degrees in engineering as BS degrees in designated fields.

● Rensselaer Polytechnic Institute has established an engineering science curriculum, effective next September, as announced recently by Dr. Clayton O. Dohrenwend, Mem. ASME, provost of the institute. The first three years of the program provide courses in basic science, mathematics, and engineering science, with courses in analysis and synthesis of engineering systems in the senior year. For the senior year program, students also will be encouraged to elect a sequence of courses either of physics or chemistry-oriented nature. V. Lawrence Parsegian, Mem. ASME, Dean of the School of Engineering, notes that the new program is particularly attractive to students who wish to prepare for graduate study and research following patterns that may be unconventional.

● The University of California at Los Angeles is beginning a five-year study of engineering education. Aided by a $1,200,000 grant from the Ford Founda-

tion, the engineering department, through its education development program, will (*a*) analyze and, if needed, change the undergraduate curriculum; (*b*) analyze and possibly modify the graduate program in research; (*c*) develop a graduate program based on the discipline of design. The roots of the program go back four years, when L. M. K. Boelter, Fellow ASME, Dean of the College of Engineering, asked if, with the intense tempo of new discoveries and their immediate applications, "engineering education, here and throughout the country, is meeting the present and future demands of the profession and the nation." The education development program planners working with Dean Boelter, among them engineering Professors Myron Tribus, Mem. ASME, and Allen B. Rosenstein, visualize design as the binding force in a seven-year engineering curriculum, starting at the freshman level and continuing as a major graduate field through the doctorate degree. They say this is a step toward solving the dilemma arising from the loss of the engineer's ability to design due to the emphasis on science courses and research.

● The University of Wisconsin is now offering a unique course in solar-energy technology to senior and graduate students in chemical and mechanical engineering. Said to be the first of its kind as a regular academic credit course, it is partly based on research in the university's Solar Energy Laboratory. The course covers three broad phases of the subject, including the study of basic concepts of availability and collection of solar radiation, application of solar radiation to house heating and cooling, and the distillation of sea water, and its application in space vehicles.

● A six-member advisory committee on industrial and management engineering has been appointed by the board of trustees of Newark College of Engineering to consult with board members and departmental chairmen on the latest industrial developments related to the management field. The committee, which brings to 30 the number of advisers to the board in all fields of engineering, includes among others, Dr. Lillian M. Gilbreth, Fellow ASME, president of Gilbreth Engineers, Inc., New York City; Phil Carroll, Fellow ASME, professional consulting engineer of Maplewood, N. J.; Richard M. Dorian, Mem. ASME, vice-president for engineering of A. and M. Karagheusian, Inc., Roselle Park, N. J.; and Eugene H. MacNiece, Mem. ASME, technical consultant with Permacel-Le Page, New Brunswick, N. J. The committee was appointed following changes in the degree program of the department of industrial and management engineering, which now offers a BSIE in addition to the MS in management engineering.

### Campus Improvements

● Plans for a 33-story industrial research center, to be known as the University City Tower, have been announced for a site adjoining the campuses of the University of Pennsylvania and the Drexel Institute of Technology. The tower's upper 28 stories will house laboratories, testing installations, and pilot plant operations. A corps of service organizations located in the building is expected to offer a wide range of special scientific and technical equipment, including a computing center, a design and construction center for producing testing equipment and bench scale models, and a reproduction and printing center for technical and research papers. The building will be designed to permit structural variations in ceiling height and other flexibilities to serve unusual space requirements of researchers. To begin construction in fall, 1961, the tower is expected to be ready for occupancy in early 1963.

● President A. Whitney Griswold of Yale University has announced a gift by C. Mahlon Kline of Philadelphia, Pa., of about $10 million for the construction of a new science center at Yale. Mr. Kline, who is honorary chairman of Smith, Kline and French Laboratories in Philadelphia, is a 1901 graduate of Yale Sheffield Scientific School. The new Kline Science Center will house a chemistry laboratory, a library, and laboratories for the biological sciences, a geology building, and a central auditorium for the sciences.

### Grants

● Of the more than $1,400,000 in grants that have been awarded for the 1961–1962 academic year to 159 universities and colleges by the E. I. du Pont de Nemours & Company, Inc., the largest share will help strengthen the education of scientists and engineers. This share includes grants totaling $654,000 awarded to more than 100 colleges and universities.

Another share for fundamental research totals $525,400, $475,000 of which was awarded to 37 universities for unrestricted research in the physical sciences, including mechanical engineering and metallurgy, among others. Fundamental research grants of $5000 each went to the Massachusetts Institute of Technology and Pennsylvania State University, in mechanical engineering; and to Carnegie Institute of Technology and Ohio State University, in metallurgy. Included in this program are summer research grants of $1800 each to 24 institutions. Those for mechanical en-

**Northeastern University's nuclear laboratory facilities in Boston, Mass., have been expanded with the installation of a subcritical reactor and a reactor simulator. Subcritical reactor, left, resembling a pickle barrel, produces a low level of fission but is incapable of a self-sustaining atomic reaction. Simulator, right, developed by Minneapolis - Honeywell Regulator Company, electronically produces effects identical to those of an actual nuclear reactor. Operation of the simulator permits students to gain experience in reactor operation and to study problems inherent in the use of a "live" reactor. Undergraduate seniors in chemical and mechanical engineering initially will be instructed in operation of the subcritical reactor and reactor simulator, said Dr. Asa S. Knowles, Mem. ASME, president of the University. Later, training will be extended to graduate students and undergraduates in other fields of study.**

gineering went to the Georgia Institute of Technology, Lehigh University, Virginia Polytechnic Institute, North Carolina State College, and the University of Connecticut.

● The Council on Library Resources in Washington, D. C., has received a grant of $8 million from The Ford Foundation for research into improved library methods, the emphasis to be placed on ways of storing and finding information in the library of the future. The council will use part of the grant to set up a laboratory for the study of photographic and electronic techniques and for the development of pilot models to improve methods of storing and retrieving information. In this way, the council says it hopes to solve major problems that now impair the efficiency of research libraries and slow the dissemination of knowledge.

### Awards Available

● The James F. Lincoln Arc Welding Foundation has established a new $25,000 award program for progress in arc welded design. The program includes 76 awards to be given for the best papers in two separate, noncompeting divisions—machines and structures. The papers are to deal primarily with ways in which the efficient application of arc welded steel can contribute to progress in machine or structural design. It is hoped that the program will elicit ideas to accelerate the progress of welded design. Full information may be obtained from the foundation in Cleveland, Ohio.

### Fellowships and Scholarships

● More than 130 business corporations, foundations, professional associations, and individuals annually sponsor four-year Merit Scholarships for high-school students to the colleges of their choice. In addition, many more Merit Scholarships come from the National Merit Scholarship Corp., which conducts the annual competition. This year, the total value of 950 stipend-bearing Merit Scholarships was estimated at $5 million. To qualify for the scholarships, the students must take a three-hour examination of educational development. The highest scorers in each state then become semifinalists, and go on to take a second examination to become finalists. A committee of evaluators, largely from the college admissions field, then makes the final selections of Merit Scholarship winners.

● A $5000 Vanguard fellowship is sponsored annually by The Martin Company in commemoration of the three successful earth satellites launched under the Vanguard project. All three are still circling the earth with a total of more than 835 million miles in orbit since the first was launched on March 17, 1958. Predoctoral students with high scholastic records in engineering and science are eligible for the fellowship. Any citizen of the 61 nations that participated in the International Geophysical Year may qualify. For further information, write William B. Bergen, President, The Martin Company, Baltimore 3, Md.

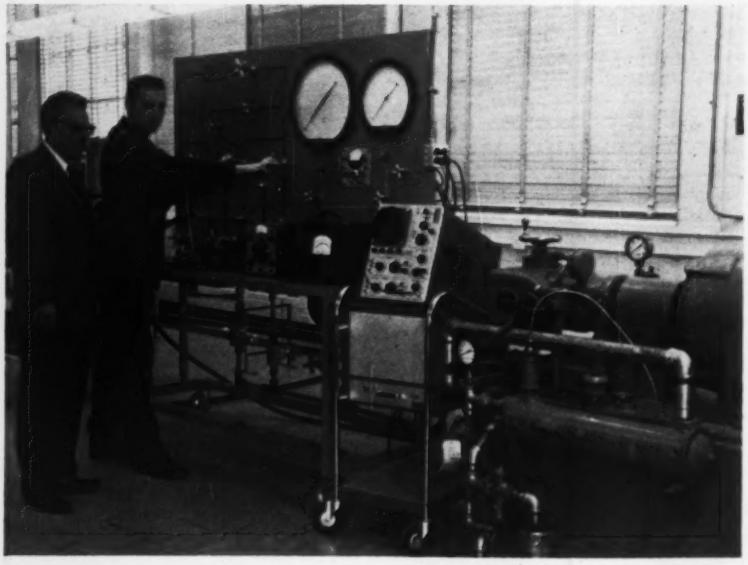
### Purdue Automatic Control Center

The Automatic Control Center of the School of Mechanical Engineering was established recently at Purdue University, staffed by more than 20 professors, research assistants, postdoctoral associates, and other personnel. The research assistants are working toward masters and PhD degrees in the School of Mechanical Engineering. New office space has been provided for the staff including a conference room. The center has a well-equipped, air-conditioned laboratory where frequency response runs are being made on hydraulic lines under ambient conditions. An analog computer well equipped for nonlinear simulation is housed in the laboratory, which also contains a test stand for general hydraulic research, electronic amplifiers, transducers, amplitude and phase analyzers, oscilloscopes, and other equipment for simulating and testing automatic control systems.

The major financial support for the center has come from the National Aeronautics and Space Administration. Substantial help has also been received from Purdue University: the National Science Foundation; the Office of Naval Research; the Foundation for Instrumentation, Education, and Research; and other sources. Research is currently going on in the areas of optimum nonlinear control, dynamic response of hydraulic systems, signal stabilization of control systems, algebraic approaches to control-system design, adaptive control, and multiple control. A Royal McBee LPG-30, Datatron, and a Remington Rand 880 are digital computers available to the staff of the center. The Mechanical Engineering Department has ordered a Royal McBee RPC-4000 digital computer which should be ready for staff use by June 1, 1961. There are currently two full professors on the staff, namely, Dr. E. H. Gamble and Dr. R. Oldenburger, Mem. ASME. Dr. Oldenburger is director of the center. Four graduate courses—some of which are open to seniors—are being offered by the staff. These are devoted to regulators and servomechanisms, statistical approaches to automatic control, nonlinear automatic control, and linear control theory. The Department of Mechanical Engineering is putting in an automatic control course for all mechanical engineering students at Purdue. Outstanding automatic control specialists are brought to Purdue to give open lectures in an automatic control seminar sponsored by the center. This seminar normally meets weekly.

Usually, graduate assistants in the center devote 20 hours to research work a week. This is thesis research. These

Prof. Rufus Oldenburger, **left**, and R. E. Goodson, graduate student, test hydraulic equipment in laboratory of Automatic Center, Purdue University



students are permitted to carry a load of 21 hours an academic year.

### New Degrees

● The University of Rochester will grant a PhD in mechanical engineering effective this fall. In addition, a revised undergraduate program in mechanical engineering also is scheduled to begin. In announcing the new degree, Dr. Martin Lessen, Mem. ASME, chairman of the department of mechanical engineering, said, "Undergraduates will be trained for advanced education, although there will be terminal programs for them ending with the BS degree providing a better background for applying their knowledge in any direction."

● The University of Dayton, Dayton, Ohio, will inaugurate a graduate program in engineering, leading to the degree of ME, in September.

● The University of South Carolina will offer graduate courses, in the areas of gas dynamics, heat transfer, applied mechanics, and properties of materials, leading to the degrees of MS and ME in mechanical engineering and beginning with the fall semester. Inquiries concerning the program may be addressed to Head, ME Department, University of South Carolina, Columbia, S. C.

### Campus Data

● The University of Texas' new Science-Engineering Center will include the world's first three-stage Tandem Van de Graaff 17.5-mev atomic particle accelerator, plus a separate four-mev atom smasher. They will be housed in a proposed $4 million center on the university's main campus at Austin, Texas.

● The first GE-225 information retrieval system, a high-speed transistorized computer, is being put to use in research in metallurgy and allied subject fields at the Center for Documentation and Communication Research, School of Library Science, Western Reserve University, Cleveland, Ohio. It provides mechanized searching for the documentation service of the American Society for Metals, as well as devising and testing strategies of mechanized searching under a grant from the Air Force Office of Scientific Research.

### Patent System Fellowship

The Thomas Alva Edison Foundation has established a $3000-a-year Thomas Alva Edison Fellowship for graduate study of the patent and related systems. The fund will be available annually to The Patent, Trademark, and Copyright Foundation of The George Washington University, Washington, D. C. Candidates for the fellowship will be nominated by the Copyright Foundation, with the final selection of the winner to be made by a screening committee composed of trustees and officials of the Edison Foundation, the Edison Research Laboratory, and the Copyright Foundation. Included in that group is Walker L. Cisler, Fellow and former president of ASME, president of the Thomas Alva Edison Foundation, and of the Detroit Edison Company.

## LITERATURE

### AEC

● Fast Breeder Reactor Program (TID-8523), has been published by the Atomic Energy Commission. Although not one of the 12 volumes of the Civilian Power Reactor Program series, the report was prepared under the supervision of the Commission's Division of Reactor Development, and briefly reviews the need for successful development of fast breeder reactors. The 12-page report is available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. Price: 50 cents.

● Selected Reactors of the Power Reactor Demonstration Program (TID-3556), has been published by the Atomic Energy Commission. A 34-page bibliographical listing, it gives the title, author, publication date, price, and availability source of 314 reports published on ten power reactor projects under construction or planned. Available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.; Price: 75 cents.

● "Status Report on Fast Reactors as of 1959," Part 3 (TID-8518 (1), Book 1), has been published by the Atomic Energy Commission. It is the third of the eight volumes comprising Part 3 (status reports) of the Commission's four-part study of the Civilian Power Reactor Program. The technological and economic status of fast (breeder) reactors are evaluated in 99 pages of text, with diagrams, graphs, and tables. British and Russian fast reactor work also is summarized. Available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price: $1.

● "3 Design Studies for Selecting a Prototype Reactor for a Nuclear Tanker" (TID-8528), is a summary and evaluation report prepared by a group convened by the AEC's Division of Reactor Development and the Maritime Administration of the U. S. Department of Commerce. The group considered three nuclear-powered tanker design and engineering studies prepared in accordance with Section 113 of Public Law 86-50. The studies, which were intended to identify a nuclear propulsion plant suitable for early and broad application to the merchant marine, were prepared by combustion Engineering, Inc., General Electric Company, and Westinghouse Electric Corp. The 67-page report is available for $1.25 from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

● "Engineering Materials List" (TID-4100), announces those engineering materials (drawings, specifications, photographs, and bills of materials) that are available in the form of full-size blueline prints to government agency contractors, industrial concerns, and the general public. The AEC has contracted with a private firm, the Cooper-Trent Blueprint and Microfilm Corp., 2701 Wilson Blvd., Arlington 1, Va., to serve as the commission's distribution center for engineering drawings. Previously this service has been conducted by the commission's Office of Technical Information Extension at Oak Ridge. Cooper-Trent will reproduce the engineering materials from reproducibles formerly maintained and stored at the Oak Ridge facility. The prints will be sold at an established price of 17 cents per sq ft. The materials list and supplements can be obtained without charge from the Office of Technical Information Extension, P. O. Box 62, Oak Ridge, Tenn., which also will take inquiries concerning materials not announced in the list.

● A new feature will soon be incorporated in each of the series of quarterly technical progress reviews published by the Atomic Energy Commission. In the next issue of "Power Reactor Technology," vol. 3, no. 4, a complete subject index will be incorporated. This particular review will contain a detailed cumulative index to all previous issues dating back to December, 1957. Indexes will be incorporated in two other re-

views, "Reactor Fuel Processing" and "Reactor Core Materials" as each approaches its third anniversary. The fourth review, "Nuclear Safety," will contain an annual index scheduled for publication in June, 1961. A three-year cumulative index will follow in June, 1962. Subsequent indexes to all reviews will appear on an annual basis. They are expected to improve the reviews' utility as reference tools.

**Miscellanea**

**Fuel-Cell Research.** A comprehensive study of fuel cells has been published recently. This book, entitled "Fuel Cells: Power for the Future," presents an economic and technical analysis of developments and opportunities in the field of electrochemical fuel cells.

The book was written by nine graduate students at the Harvard Business School. They spent almost one year interviewing leading scientists in the field, reviewing papers on fuel cells, and analyzing activities of companies doing fuel-cell research.

*(Continued on page 105)*

## PEOPLE

**Honorary Degrees.** HERMAN C. HESSE, Mem. ASME, dean of engineering at Valparaiso University, Valparaiso, Ind., and JOHN R. PIERCE, director of research in communications principles of Bell Telephone Laboratories, received honorary Doctor of Engineering degrees on June 8 at the 45th commencement exercises of Newark College of Engineering.

CHARLES H. PRANGE, Mem. ASME, president of Austenal Incorporated, New York, N. Y., received an honorary Doctor of Engineering degree at Stevens Institute of Technology commencement exercises on June 10.

**Honors and Awards.** SANFORD L. CLUETT, Troy, N. Y.; WILLIS F. THOMPSON, New Haven, Conn.; and FREDERICK H. ROLT of Hampton, Middlesex, England, were recently elected Honorary Members of ASME.

ROBERT G. LETOURNEAU, Fellow ASME, will be a joint recipient along with the Research and Development Division of the Firestone Tire and Rubber Company, of the Elmer A. Sperry Award for 1961, to be presented at a meeting of the Society of Automotive Engineers on September 12 in Milwaukee, Wis. Mr. LeTourneau is being honored for his development of large-capacity, high-speed, automatic earth-moving equipment. He also holds the 1961 ASME Machine Design Award.

RUFUS OLDENBURGER, Mem. ASME, has received the 1960 ASME Automatic Control Division Annual Award for his advanced work in the solution by mathematics and mathematics shortcuts of automatic control problems.

CLAUDE L. CLARK, Mem. ASME, metallurgical engineer on tubing applications for The Timken Roller Bearing Company, will receive the 1961 Albert Sauveur Achievement Award of the American Society for Metals at ceremonies in Detroit, Mich., later this year.

KENNETH FRANKLIN TUPPER, Mem. ASME, president of Ewbank and Partners (Canada) Ltd., Toronto, has been made an honorary member of the Engineering Institute of Canada.

HERBERT WILLIAM HEINRICH, Mem. ASME, chairman of the Uniform Boiler and Pressure Vessels Society, New York, N. Y., has been elected a fellow of the American Society of Safety Engineers.

At the 75th annual general meeting of the Engineering Institute of Canada, held in Vancouver, B. C., May 31–June 2, the following medals were awarded to Canadian authors of engineering papers: the Sir John Kennedy Medal (1960) to H. R. SILLS, Canadian General Electric Company; the Julian C. Smith Medal (1960) to A. DUPERRON, formerly of The Montreal Transportation Commission; The Gzowski Medal (1960) to C. H. TEMPLETON, Templeton Engineering Company; The Leonard Medal to J. A. HALL, Gaspe Copper Mines Ltd.; The Plummer Medal to R. N. BOYD and V. J. BAKANOWSKI, duPont Company of Canada Ltd.; The Duggan Medal and Prize to S. D. LASH and B. B. HOPE, Queen's University; The R. A. Ross Medal to L. M. HOVEY, The Manitoba Hydro-Electric Board; The Robert W. Angus Medal to J. B. BRYCE, Hydro Electric Power Commission of Ontario; and the John B. Galbraith Prize to R. H. WILKINS, Belleville, Ontario.

The 1961 Industrial Professional Development Award of the National Society of Professional Engineers was presented on July 7 to the General Electric Company's Transformer Division in Pittsfield, Mass., and Instrument Department, West Lynn, Mass. The two winners, chosen on the basis of engineering professional development policies and programs, were honored at the society's annual meeting in Seattle, Wash.

JOHN G. TRUMP, of the Massachusetts Institute of Technology, received the American Institute of Electrical Engineers Lamme Gold Medal recently at the institute's summer general meeting at Cornell University.

HOWARD BIERS, of New York, distinguished metallurgist and consulting engineer, has been elected an honorary vice-president of The Iron and Steel Institute, London. Dr. Biers is the first American ISI honorary vice-president since the death in 1943 of James Farrell, president of U. S. Steel Corporation. Announcement of the honor coincided with AIME's designation of him as its representative at the ISI annual general meeting held May 3–4.

ALLEN B. DUMONT, industrialist and television pioneer, will receive an AIEE certificate of honorary membership at the opening session on June 19. Dr. DuMont founded the Allen B. DuMont Laboratories, Inc., which merged with Fairchild Camera and Instrument Corporation, Syosset, N. Y.

HASAN T. GENCSOY, assistant professor of mechanical engineering at West Virginia University, has been awarded a $1500 grant by the Welding Research Council of New York. It will finance his study of residual stresses in a flat metal plate after welding.

LIEF J. SVERDRUP, president and director of the engineering firm Sverdrup and Parcel, Inc., will receive the 1961 National Society of Professional Engineers Award for outstanding service to the engineering profession at the banquet session of the society's annual meeting in Seattle, Wash., July 4–7.

ROBERT Q. SHARPE, Mem. ASME, Socony Mobil Oil Company, New York, N. Y., won the Wilbur Deutsch Award of the American Society of Lubrication Engineers for the most practical paper of the year. He wrote on "Reducing Leakage From Hydraulic Systems." The award was presented at the ASLE annual meeting on April 12 at the Bellevue Stratford Hotel in Philadelphia, Pa. On the same occasion, ASLE also presented the Capt. Alfred E. Hunt Award to ROBERT L. JOHNSON and DONALD H. BUCKLEY of the National Aeronautics and Space Administration; and the Walter D. Hodson Award to J. P. WETTACH of Dravo Corporation, Pittsburgh, Pa.

The Society of American Military

Engineers presented the following awards for 1960 during its 41st annual meeting on May 15 at the Mayflower Hotel, Washington, D. C.: The Society Gold Medal to MAJ. GEN. G. J. NOLD, USA, ret.; the George W. Goethals Medal to LIEUT. GEN. S. D. STURGIS, JR., USA, ret.; the Moreell Medal to VICE ADM. W. O. HILTABIDLE, USN, ret.; the Wheeler Medal to COL. C. H. WHITESELL, Corps of Engineers, USA; the Colbert Medal to CAPT. W. F. MALNATE, U. S. Coast and Geodetic Survey; the Newman Medal to BRIG. GEN. W. E. LEONHARD, USAF; the Bliss Medal to REAR ADM. L. B. COMBS, CEC, USN, ret.; the Toulmin Medal to LIEUT. COMDR. J. C. LEDOUX, USN; the Itschner Award to CAPT. A. L. SCHNEIDER, USA; The Peltier Award to COMDR. F. W. ARNOLD, CEC, USNR; and the Karo Award to the Louisiana Low Water Line Survey Party.

**Appointment.** RICHARD G. FOLSOM, Fellow ASME, president of Rensselaer Polytechnic Institute, Troy, N. Y., has been appointed chairman of the Special Advisory Committee of the Building Research Advisory Board for the Study of Building Research in the National Bureau of Standards. The appointment was announced recently by DETLEV W. BRONK, Hon. Mem. ASME, president of the National Academy of Sciences–National Research Council.

CHESTER A. ARENTS, Mem. ASME, dean of West Virginia University's College of Engineering, has been appointed to a joint committee on training for government service of the American Association of Land-Grant Colleges and State Universities and the U. S. Department of Agriculture. He will represent engineering in discussions concerning the Department of Agriculture's requirements for career employees as well as engineering activities of colleges and universities.

RALPH S. BARNABY has been named manager of project development at The Franklin Institute Laboratories for Research and Development. Captain Barnaby, former principal engineer in the institute's Operations Analysis Laboratory, also had a 30-year career in Naval aviation.

The National Academy of Sciences' National Research Council has announced two appointments to its Committee on Ship Structural Design. They are J. HARVEY EVANS, associate professor of naval architecture at the Massachusetts Institute of Technology; and JOHN WILDER MILES, professor of engineering and geophysics at the University of California, Los Angeles.

ROBERT W. TRUITT, technical author and aerospace engineer, has been named head of North Carolina State College's Department of Mechanical Engineering, effective June 1. Dr. Truitt has resigned as professor and head of the aerospace engineering department at Virginia Polytechnic Institute, Blacksburg, Va., to accept the post. He also is currently a consultant for the aerophysics section of NASA.

**New Officers.** CARL H. SIMON, Mem. ASME, has been elected to the board of directors of the American Standards Association for a three-year term. Mr. Simon is general manager of Darling Valve and Manufacturing Company, Williamsport, Pa., and vice-president of its two Canadian subsidiaries. He will represent the valve and fittings industry on the board.

The Consulting Engineers Council installs its new national officers at the fifth annual meeting of the board of directors in Chicago, May 2–4. HAROLD P. KING, consulting engineer of Sherman Oaks, Calif., is the new president. Serving with him will be CEDRIC R. ACHESON, Syracuse, N. Y., first vice-president; and SANFORD K. FOSHOLT, Mem. ASME, Muscatine, Iowa, second vice-president.

HAROLD R. TERHUNE, manager of standards at the International Telephone and Telegraph Corporation laboratories, will become president of the Standards Engineers Society at its annual meeting, September 18–20, in Chicago. He is former editor of *Standards Engineering*, the society's bimonthly magazine.

ROBERT W. VAN HOUTEN, president of the Newark College of Engineering and director of the Newark Technical School, assumed office July 1 as president for 1961–1962 of the American Society for Engineering Education.

A. F. CHOUINARD, director of research and development of the National Cylinder Gas Company, is the new president of the American Welding Society effective June 1. He was presented to the membership on April 17 at opening ceremonies of the 42nd annual meeting of the society at the Hotel Commodore, in New York City.

J. A. STRATTON, president of the Massachusetts Institute of Technology, was elected to a four-year term as vice-president of the National Academy of Sciences on April 25 at the academy's 98th annual meeting in Washington, D. C. Two new members also were elected for three-year terms to the academy's National Research Council. They are G. B. KISTIAKOWSKY, Abbott and James Lawrence Professor of Chemistry, Har-

Rawleigh M. Johnson, **left,** Fellow ASME, was honored at a luncheon on June 19, 1961, in New York, N. Y., and presented with a certificate of appreciation in acknowledgment of his work during his five years as Chairman of the Power Test Codes Committee from 1955–1960. The presentation was made by William H. Byrne, President of the Society.

Thomas I. Stephenson, **left,** manager of Tennessee operations of the Aluminum Company of America, receives his certificate for promotion to Fellow Grade in ASME from Roy C. Robertson, **right,** vice-president of ASME Region IV. Looking on, **center,** is W. R. Chambers, the only other ASME Fellow in Knoxville, Tenn.

vard University; and KENNETH B. RAPER, professor of bacteriology and botany, University of Wisconsin.

DEAN M. CLEAVELAND, Bendix Corporation, South Bend, Ind., is the new president for 1960–1961 of the American Society of Lubrication Engineers. He was elected at the society's annual meeting April 11–13 in the Bellevue Stratford Hotel, Philadelphia, Pa. A. E. CICHELLI Assoc. Mem. ASME, Bethlehem Steel Corporation, was re-elected secretary of the society.

CHARLES T. BLAKE, Mem. ASME, director of engineering for Warner and Swasey Company, was installed on May 26 as president of the Cleveland Engineering Society for 1961–1962.

RICHARD G. FOLSOM, Fellow ASME, and president of Rensselaer Polytechnic Institute, has been elected president of the Association of Independent Engineering Colleges at its annual meeting held in New York City.

A. V. FEIGENBAUM, Mem. ASME, manager of Manufacturing Operations and Quality Control for General Electric, headquartered in New York City, has been named president of the American Society for Quality Control.

HAROLD A. BERGEN, Assoc. Mem. ASME, vice-president of Burson-Marsteller Associates, becomes a member this month of the national assembly of the Public Relations Society of America. He comes to the assembly from his post as recently elected national director of the American Public Relations Association, which is merging with PRSA.

WARREN H. CHASE, vice-president of the Ohio Bell Telephone Company, Cleveland, will take office on August 1 as president for 1961–1962 of the American Institute of Electrical Engineers. Also to assume duties as a district vice-president is THOMAS E. MARBURGER, Mem. ASME, assistant general superintendent of electrical operations for Baltimore Gas and Electric Company, Baltimore, Md.

New officers of the American Society of Heating, Refrigerating and Air-Conditioning Engineers were installed at the society's annual meeting, June 26–28, in Denver, Colo. JOHN EVERETTS, JR., became president; JOHN H. FOX, first vice-president; FRANK H. FAUST, second vice-president; and JOHN E. DUBE, treasurer.

MURRAY A. WILSON, consulting engineer of Salina, Kan., is the new president of the National Society of Professional Engineers.

SIR KENNETH HAGUE, Mem. ASME, is the new president of The Institution of Mechanical Engineers. Sir Kenneth is chairman of Babcock & Wilcox, Ltd., London, England. The institution's new secretary is K. H. PLATT, formerly deputy secretary.

CLYDE L. PALMER, city engineer for the City of Detroit, is the new president of the Engineering Society of Detroit. Among others serving with him are secretary GLENN V. EDMONSON, Mem. ASME, University of Michigan; treasurer, JOHN M. CAMPBELL, Mem. ASME, General Motors Corporation; assistant treasurer, JOHN J. UICKER, Mem. ASME, University of Detroit; and on the society's board of directors, DONALD E. JAHNCKE, Mem. ASME, Ford Motor Company, and GEORGE A. PORTER, Fellow ASME, Detroit Edison Company.

MILES N. CLAIR, president, The Thompson and Lichtner Company, Inc., Brookline, Mass., has begun a one-year term of service as president of the American Society for Testing Materials. His election was announced during the society's 64th annual meeting in Atlantic City, N. J., on June 27.

JAMES R. CHAMBERS, Appleton Electric Company, Chicago, Ill., is the new president for 1961–1962 of the Illuminating Engineering Society, and will take office on October 1.

**Campus Data.** ROBERT T. WEIL is the new dean of the school of engineering at Manhattan College, effective July 1. He succeeds BROTHER AMANDUS LEO, F. S. C., dean of the school for 31 years. Prof. Weil headed the college's electrical-engineering department since 1945.

MILTON C. SHAW, Mem. ASME, has been appointed head of the department of mechanical engineering at Carnegie Institute of Technology, and will assume his duties for the 1961–1962 academic year.

REINOUT P. KROON, Fellow ASME, has been appointed by the University of Pennsylvania to fill its new faculty chair, the George Westinghouse Professorship of Mechanical Engineering, established by the Westinghouse Educational Foundation. Mr. Kroon, who is well known for his contributions to aeronautical progress in the turbojet power-plant field, received the ASME Spirit of St. Louis Medal in 1950.

WILLIAM T. ALEXANDER, Mem. ASME, dean of the college of engineering at Northeastern University, will assume duties on September 1 as the new administrator of the Webb Institute of Naval Architecture, Glen Cove, L. I., N. Y.

BEATRICE A. HICKS, Mem. ASME, Montclair, N. J., and LOUIS PICKETT, Assoc. Mem. ASME, West Nyack, N. Y., received the Newark College of Engineering Alumnus of the Year award at the college's 45th commencement exercises on June 8.

TALMAN W. VAN ARSDALE, JR., Worcester Polytechnic Institute's executive vice-president, assumed a new post as president of Bradley University, Peoria, Ill., on July 1.

**Anniversary.** The Engineering Society of Detroit celebrated its 25th anniversary in April by focusing the attention of its 6000 members on Michigan's future economy and technical leadership in the nation. The society was founded April 15, 1936.

Charles S. Schroeder, **center,** Mem. ASME, receives the 1961 Material Handling Award of the Society for the Advancement of Management from Warren J. King of Albert Ramond and Associates, the society's vice-president for material handling. SAM president, James E. Newsome, of Johnson and Johnson, Chicago, Ill., witnesses the presentation. The award was made at a luncheon meeting in the Statler Hilton Hotel, New York City, during the two-day Engineering Management Conference cosponsored by the ASME Management Division.

## MEETINGS OF OTHER SOCIETIES

### • IN THE UNITED STATES

**August 22–25**

Western Electronics Show and Conference (WESCON), Cow Palace, San Francisco, Calif.

**August 23–25**

Fourth Biennial Gas Dynamics Symposium, sponsored by The American Rocket Society and Northwestern University, Evanston, Ill.

**August 23–26**

NCSBEE, annual meeting, Hotel Buena Vista, Biloxi, Miss.

**September 6–8**

Seventh Midwestern Conference on Fluid Mechanics and Solid Mechanics, Michigan State University, East Lansing, Mich.

**September 6–8**

Joint Nuclear Instrumentation Symposium,

sponsored by AIEE, ISA, et al., North Carolina State College, Raleigh, N. C.

**September 12**

SPE, regional technical conference on plastics for tools, Severin Hotel, Indianapolis, Ind.

**September 12–14**

Southeastern Maintenance and Engineering Show, sponsored by American Institute of Plant Engineers, Greensboro War Memorial Coliseum, Greensboro, N. C.

**• IN MEXICO**

**August 31–September 12**

Electric Power Seminar, including sessions on prospects and problems of nuclear power, sponsored by the United Nations Economic Commission for Latin America and the International Atomic Energy Agency, to be held in Mexico City, Mexico.

**• IN EUROPE**

**August 21–31**

United Nations Conference on New Sources of Energy; and an industrial-commercial exhibition of equipment showing developments in solar, wind, and geothermal energy fields, organized by Rassegna Internazionale Elettronica, both in Rome, Italy.

**August 23–26**

Institute of Management Sciences, eighth annual international meeting, Palais des Congres, Brussels, Belgium.

**September 26–29**

International Meeting on Heavy Forging, organized by the Camera di Commercio, Industria e Agricoltura with the co-operation of the Associazione Italiana di Metallurgia, to be held in Terni, Italy.

**September, 1961**

European Organization for Quality Control, fifth annual meeting, Turin, Italy.

**November 13–16**

National Maintenance Conference and Exhibition, organized by *Plant and Factory Maintenance*, to be held at The Central Hall, Westminster, London, England.

**November 16–25**

Hungarian Scientific Society for Mechanical Engineering, International festival of scientific and technical films for mechanical engineering, Budapest, Hungary.

**• IN CANADA**

**August 15–18**

TAPPI, testing conference, Queen Elizabeth Hotel, Montreal, Que.

**October 19–November 7**

The Iron and Steel Institute, special meeting in the U. S. and Canada.

**• IN JAPAN**

**November 6–11**

Society of Chemical Engineers, Japan, 25th anniversary congress exhibition, Sankei Hall, Tokyo, Japan.

*(For ASME Coming Events, see page 119.)*

# United Engineering Center

**UEC.** *View as of June 30, 1961*

**A UEC Contributor Writes . . .** "I feel compelled to make this contribution because when we who raise the plaintive cry, '. . .but I'm a professional,' do not support something as fundamental as this; when we default on this most demonstrative proof of membership in a profession; then it can only be that we fail to understand what it is that we so ardently proclaim to be. Every preceptual arch of this or any profession is held aloft by the keystone of individual self-sacrificial advancement of that profession by its members. If ever we are to be differentiated from train drivers, it must be by emulating those who have already given of themselves so generously in the cause of the United Engineering Center Building Fund."

William L. Osborn, Assoc. Mem. ASME

28 South Church Street,
Waynesboro, Pa.

Notes on Society Activities and Events

E. S. NEWMAN
News Editor

# THE ASME NEWS

## ASME's Professional Divisions Decentralize

### Four Technical Departments Established
### Purpose: More and Better Service to Members

DECENTRALIZATION has become an immediate need in ASME's technological service to its membership. By technological service is meant the gathering, reviewing, and publishing of technical papers, the planning of technical conferences for the presentation and discussion of papers, and the acceptance and carrying out of the Society's research projects. As the profession becomes more and more partitioned into specialties—as represented by ASME's 24 Divisions—it becomes increasingly difficult for a single Board on Technology to give the Divisions and publications the service they need.

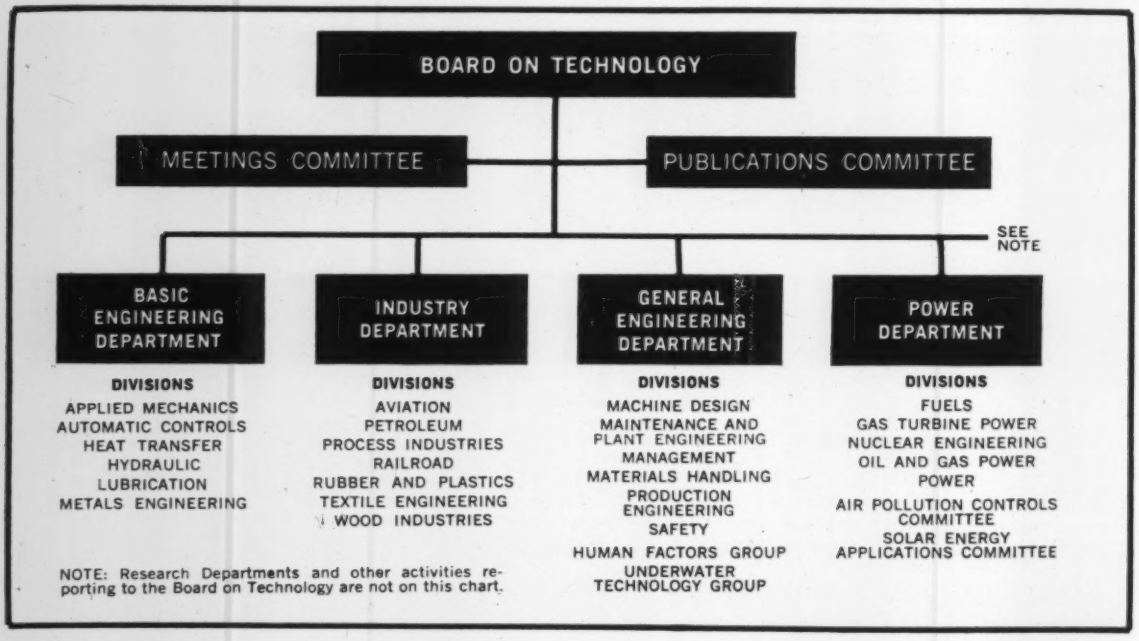
Who decides where and when a Division shall hold a conference? Who sees to it that the conference is not in conflict with another which will detract from attendance? If the conference is to be held jointly with another society, who sees that this is done? Who determines whether the individual Divisions are each producing the amount and range of technical literature their specialties warrant? How good are the recommendations given the Editorial Department for the placing of technical articles in the several publications?

It has become too much for a single Board on Technology.

The chart which accompanies this report indicates the Society's new grouping of Divisions into four Departments. It will be the function of the Department Executive Committee to exert technical leadership and imagination within its area.

#### Down to Cases

Since the previous structure whereby all Divisions reported to the Professional Divisions Executive and Planning Committees for supervision and administration was believed to be cumbersome and unresponsive to technical needs, four Technical Departments have been established under the Board on Technology. The four departments are: Basic Engineering, Industry, General Engineering, and Power. The accompanying chart diagrams the setup, and shows the Divisions which belong with each Depart-



ment. Each Department will be responsible for the specialized activities under its jurisdiction, including Division Conferences and the effectiveness of the departmental contributions to the Society's publications.

**Department Executive Committees.** Each Department will be managed by a Department Executive Committee composed of three members-at-large on a rotating basis plus the Chairman of each of the Professional Divisions and Groups within the Department. The Chairman of each DEC will have a seat on the Board on Technology. It is the function of each DEC to exert technical leadership and imagination within its area. In so doing, the DEC Committee will act as the co-ordinator or referee, when necessary, between the various professional activities, and more importantly, it must review the past performance, current activities, and future plans of each of the Divisions regularly, and report to the Board on Technology on their current health.

**Meetings Committee.** The Meetings Committee—shown on the chart—will be responsible for the planning of the technical programs for the general meetings of the Society on a national level, and as requested on a Sectional or Regional level. The Committee will consist of five voting members-at-large on a rotating basis, plus an advisory member from each Department and from each Region.

In addition to supervising the over-all planning of the national general meetings of the Society, the Meetings Committee will: Develop policies and procedures for conducting national meetings and conferences of ASME and the participation of ASME units in meetings and conferences of other societies; coordinate the activities of the Department Program Committees when necessary; pursue aggressively Section-Division cooperation and to establish the means whereby the Sections can plan satisfying technical programs drawing, when necessary, upon the resources of the various Professional Divisions; review the past performance, current activities, and future plans of each Department Program Committee regularly, and report to the Board on Technology on their performance.

**Publications Committee.** The Publications Committee will operate under the Board on Technology with the chairman having a seat on the Board. The Committee will consist of five voting members-at-large on a rotating basis, plus an advisory member from each Department and from each Region.

The Committee will be responsible for developing policies and for making operating decisions for the publications of ASME, both periodical and special. It will be responsible for providing imaginative leadership, especially through MECHANICAL ENGINEERING and the Transactions of The ASME, to serve the technical interests of ASME members in a technological era of rapid change. The reviews of technical papers and other technical contributions in the various specialties would remain the responsibility of the Divisions, monitored by the Divisions' Papers Committees.

The functions of the Publications Committee are listed as: Establishing policies concerning the publications of ASME, both special and periodical; having final responsibility regarding material to be published; supervising the over-all planning of MECHANICAL ENGINEERING and the Transactions, including recommending to the Board of Technology the establishment or discontinuance of quarterly journals of the Transactions; reviewing and reporting to the Board on Technology and the ASME Secretary its recommendations regarding special publications of the Society; regularly reviewing the past performance, current activities, and future plans of the Department Editorial Committees and the Division Papers Committees, and reporting to the Board on Technology on their findings.

**Research Program.** Efforts have so far been devoted to the immediate problems of the Professional Divisions and the means for improving their effectiveness in serving the membership. The Research Program of the Society has been a matter for independent study and its operation, therefore, has not been made a part of the current reorganization. The ASME Research Program is now being studied by another subcommittee of the Board on Technology.

### Growth Calls for Change

Although ASME has doubled in membership since World War II, and the field of mechanical engineering has broadened immeasurably in scope, until now there has been no decentralization of the "authority" of the Society. The basic organization above the Division structure remained essentially as set up.

The wisdom of decentralization has been proved during the past two years by the success of the new Transactions publications. The Editorial Department, guided by the Publications Committee, split the ASME Transactions into a series of quarterly publications covering subdivisions of the Society's activities. This has proved notably effective in making the technical literature available to members in a form most useful to them. It is expected that the new subdivision of leadership for the Divisions will produce equally gratifying results in the conduct of Division operations.

It will free the Board on Technology as well as the Meetings and Publications Committees for their primary function of assessing the way in which the Society reflects the technical interests of the mechanical engineer. It will permit more consideration of over-all policy, particularly in relation to Section-Division liaison.

Are you located far from the big cities where technical conferences and meetings are usually held? Do the general meetings in your Section provide less technical information than you need? We expect active participation by Regional representation within the new technical framework to provide communication, enabling you to help create and take part in the Society's program.

As Executive Committees are appointed, MECHANICAL ENGINEERING will keep you informed. We want to get closer to our 60,000 members and to provide still better technological support for them in their professional careers. We believe the new organizational force will supply the power to do this.

## Engineering Societies Library —Mobile Temporarily

THE Engineering Societies Library will move its 180,000 volumes—about six miles of books—to the United Engineering Center at 345 East 47th Street, New York 17, N. Y., shortly after completion of the building which is scheduled for Aug. 1, 1961. It is expected that moving of the Library will take about three weeks During this time the ESL expects to continue to answer, but probably with some unavoidable delays, all requests received by mail for general engineering information, and for all services, including literature searches, translations, and microfilm and photocopies from publications in the Library. The Reading Room will be closed, and telephone service will be curtailed for approximately the period of the move.

It is hoped that the Library will again be giving full service by Labor Day or soon thereafter.

# Five Engineering Societies Meet at Boulder, Colo., for Joint Automatic Control Conference

Some 600 engineers and scientists from five engineering societies met at Boulder, Colo., June 28–30, for the annual Joint Automatic Control Conference. The Instrument Society of America hosted the sessions which were held on the campus of the University of Colorado. Other participating societies included: The American Society of Mechanical Engineers, the American Institute of Chemical Engineers, the American Institute of Electrical Engineers, and the Institute of Radio Engineers.

The opening session included two invited addresses: "Heuristic Aspects of Adaptive Control," by M. L. Minsky, and "Modern Research in Automatic Control," by K. Chen.

Later the same day, sessions were held on the topics: Theory of optimilization, hydraulic and pneumatic control, and economic parameters in process control. An address by Ewan Clague, a recognized authority on labor and automation, rounded out the first day's events. Mr. Clague is the Commissioner of the Bureau of Labor Statistics, U. S. Department of Labor. His address on "Social and Economic Aspects of Automation" was regarded by many as the high point of the conference.

In discussing the problems of technological unemployment he stressed the trend toward white-collar work. Clague urged engineers and scientists to cooperate in planning steps to deal with automation and its effect on employment. "You who are the creators and developers of the new technology have an interest as citizens in the social and economic consequences of your activities," he said.

On the second day of the conference two sessions on Aerospace Vehicle Control received a lot of attention and provoked a good bit of comment. There were two ASME papers delivered during these sessions: "Derived-Rate Increment Stabilization: Its Application to the Attitude Control Problem," by J. C. Nicklas and H. C. Vivian; and "Gyroscopic Coupling in Space Vehicle Attitude Control Systems," by Robert H. Cannon, Jr. The first paper analyzed a gyro-free nonlinear attitude control system for a spacecraft. In the other, the author discussed some problems of controlling the attitude of a space vehicle. He explained that while precision requirements might be extreme —less than 0.1 second of arc—the required response time may be very slow, measured in minutes or hours. Vehicles weighing tons have to be controlled by inch-ounces of torque.

Other topics discussed during the day were: Optimal switching, process dynamics, and automatic control applications.

A special banquet held at the Harvest House concluded the day's events. It was highlighted by an outdoor steak barbeque with Western style entertainment.

Adaptive control systems, nonlinear control systems, and statistical design consideration were topics at the last day's morning sessions. At noon a panel gave an informal report on automatic control in Japan. This report was presented by the U. S. Automatic Control Team to Japan. The group had previously toured Japanese industrial and educational automatic control facilities.

The last set of sessions covered the topics: Process and control nonlinearization, time series and process identification, and special topics in control.

Of the 55 papers presented at these sessions, 12 were sponsored by the ASME Automatic Control Divison.

An availability list of papers presented at this meeting follows. Digests of all numbered papers which are not scheduled for publication in Mechanical Engineering will appear in the ASME "Technical Digest" in this or a forthcoming issue of Mechanical Engineering.

## Availability List—Joint Automatic Control Conference

The papers in this list are available in separate copy form until April 1, 1962. Please order by paper number; otherwise the order will be returned. You can save the postage and handling charges by including your check or money order made payable to ASME with your order and sending both to the ASME Order Department, 29 West 39th Street, New York 18, N. Y. Papers are priced at 50 cents each to members; $1 to nonmembers. Payment also may be made by free coupons distributed annually to members, or coupons which may be purchased from the Society. Coupons, in lots of ten, are $4 to members; $8 to nonmembers.

**61—JAC-1** The Structure of Optimum Control Systems, by B. Friedland

**61—JAC-2** On the Existence of Optimal Controls, by L. Markus and E. B. Lee

**61—JAC-3** Time Optimal Control of Nonlinear Processes, by E. B. Lee

**61—JAC-4** On the Periodic Modes of Oscillation in Pulse-Width-Modulated Feedback Systems, by E. I. Jury and T. Nishimura

**61—JAC-5** Stability of a Nonlinear Feedback System in the Presence of Gaussian Noise, by R. Sridhar and R. Oldenburger

**61—JAC-6** Optimal Control Methods for On-Off Sampling Systems, by W. L. Nelson

**61—JAC-7** Minimum Time Control of Second Order Pulse-Width-Modulated Sampled-Data Systems, by E. Polak

**61—JAC-8** Gyroscopic Coupling in Space Vehicle Attitude Control Systems, by R. H. Cannon, Jr.

**61—JAC-9** Derived-Rate Increment Stabilization: Its Application to the Attitude Control Problem, by J. C. Nicklas and H. C. Vivian

**61—JAC-10** A Successive Approximation Technique for Optimal Control Systems Subject to Input Saturation, by Yu-Chi Ho

**61—JAC-11** Optimal Pursuit Strategies in Discrete-State Probabilistic Systems, by J. H. Eaton and L. A. Zadeh

**61—JAC-12** A Switching Criterion for Certain Time-Optimal Regulating Systems, by E. R. Rang

**61—JAC-13** Optimizing Control of Single Input Extremum Systems, by J. S. Frait and D. P. Eckman

# 1961 ASME Applied Mechanics Conference Held in Chicago

The Applied Mechanics Division of The American Society of Mechanical Engineers, in co-operation with the Chicago Section of the Society, held its annual conference on June 14 through 16 at Illinois Institute of Technology, Chicago, Ill.

During the technical sessions the discussions developed such topics as: Elastic plates, elastic wave theory, vibrations and stability, fluid dynamics, and plasticity. To round out the program there were also two general lectures. The first, delivered by Prof. Dave Fultz of the University of Chicago, was on "Experiments in Fluid Mechanics for Geophysical Purposes"; and the other, by Prof. A. Bryson of Harvard University, covered "Optimal Trajectory Problems."

A reception and banquet highlighted the proceedings of the conference. Dr. Jerome Namias, Chief, Extended Forecast Section, U. S. Weather Bureau, as principal speaker of the evening, addressed himself to the topic, "Abnormal Weather Patterns."

An availability list of papers presented at this meeting follows. Digests of all numbered papers which are not scheduled for publication in Mechanical Engineering will appear in the "ASME Technical Digest" in forthcoming issues of Mechanical Engineering.

## Availability List— Applied Mechanics Conference

The papers in this list are available in separate copy form until April 1, 1962. Please order only by paper number; otherwise

the order will be returned. You can save the postage and handling charges by including your check or money order made payable to ASME with your order and sending both to the ASME Order Department, 29 West 39th Street, New York 18, N. Y. Papers are priced at 50 cents each to members; $1 to nonmembers. Payment also may be made by free coupons distributed annually to members, or coupons which may be purchased from the Society. Coupons, in lots of ten, are $4 to members; $8 to nonmembers.

**61—APM-1** Uniqueness in the Optimum Design of Structures, by T. C. Hu and R. T. Shield

**61—APM-2** The Effect of a Longitudinal Gravitational Field in the Supercavitating Flow Over a Wedge, by A. J. Acosta

**61—APM-3** On Classical Plate Theory and Wave Propagation, by M. A. Medick

**61—APM-4** Stress Distribution on the Boundary of a Circular Hole in a Large Plate During Passage of a Stress Pulse of Long Duration, by A. J. Durelli and W. F. Riley

**61—APM-5** Thermodynamic Analysis of the Darcy Law, by R. G. Mokadam

**61—APM-6** Minimum Transfer Time for a Power-Limited Rocket, by G. Leitmann

**61—APM-7** A Bifurcation Phenomenon of Static Friction, by F. F. Ling and R. S. Weiner

**61—APM-8** On the Aeroelastic Instability of Bluff Cylinders, by G. V. Parkinson and N. P. H. Brooks

**61—APM-9** An Extension of Duhamel's Analogy to Plasticity, by S. A. Murch

**61—APM-10** Whirling of Unsymmetrical Rotors, by P. J. Brosens and S. H. Crandall

**61—APM-11** Bending of a Cantilever Plate Supported From an Elastic Half Space, by N. C. Small

**61—APM-12** Propagations of Elastic Waves Generated by Dynamical Loads on a Circular Cavity, by A. C. Eringen

**61—APM-13** The Effect of a Rigid Elliptic Inclusion on the Bending of a Thick Elastic Plate, by Fu Chow

**61—APM-14** Extensional Vibrations of Elastic Orthotropic Spherical Shells, by W. H. Hoppmann II and W. E. Baker

**61—APM-15** Bending of a Thin Cylindrical Shell Subjected to a Line Load Around a Circumference, by H. R. Meck

**61—APM-16** The Stresses in an Elastoplastic Bar Subjected to a Sudden Change of Surface Temperature, by E. W. Parkes

**61—APM-17** Gas - Lubricated Cylindrical Journal Bearings of the Finite Length, Part 1—Static Loading, by B. Sternlicht

**61—APM-18** The Elastic, Plastic Bending of a Simply Supported Plate, by G. Eason

**61—APM-19** Combined Stresses in an Orthotropic Plate Having a Finite Crack, by D. D. Ang and M. L. Williams

**61—APM-20** Theoretical Pressure Distribution in Journal Bearings, by K. Habata

**61—APM-21** Bending and Stretching of Certain Types of Heterogeneous Aeolotropic Elastic Plates, by E. Reissner and Y. Stavsky

**61—APM-22** Torsion of Sandwich Plates of Trapezoidal Cross Section, by Shun Cheng

**61—APM-23** Viscoelastic Effects in Birefringent Coatings, by P. S. Theocaris and C. Mylonas

**61—APM-24** Plastic Stress-Strain Relationships—Further Experiments on the Effect of Loading History, by J. Parker and J. Kettlewell

**61—APM-25** The Effect of Rotatory Inertia and of Shear Deformation on the Frequency and Normal Mode Equations of Uniform Beams With Simple End Conditions, by T. C. Huang

**61—APM-26** Diffraction of a Pressure Wave by a Cylindrical Cavity in an Elastic Medium, by M. L. Baron and A. J. Matthews

# The Business Meeting—ASME Summer Annual Meeting

The Business Meeting of The American Society of Mechanical Engineers convened at 4:45 p.m., Monday, June 12, 1961, in the Golden State Room of the Statler Hilton Hotel, Los Angeles, Calif.

**1962 Summer Annual Meeting.** O. B. Schier, II, Secretary, ASME, announced that the 1962 Summer Annual Meeting will be held June 10–14, at the Chateau Frontenac, Quebec, Canada.

**Constitutional Amendments.** Secretary Schier discussed the preparation of a general revision of the constitution and by-laws, without any substantive changes which normally would require a vote of the membership. These changes, suggested by the Constitution and By-Laws Committee, would be to transpose certain items from the constitution to by-law status and other items from by-law status to constitutional status. Thus an improvement in the arrangement of the material would result.

**1962 Nominating Committee Elected.** Members and alternates for the 1962–1963 Regular Nominating Committee, who were selected by the members in session at the ten Regional Administrative Committee meetings held during the spring, were elected. (See page 110, this issue.)

**Intersociety Relationship Committee.** R. B. Smith reported briefly that the committee has been doing much work to bring about a plan for strategically approaching the unity question and on sounding out all of the Founder Societies on their willingness to join in a movement toward unity in the engineering profession. Mr. Smith announced that a formal report would be submitted soon.

**United Engineering Center.** Mr. Schier announced that the new center would soon be ready for occupancy and invited the members to visit the building during the Winter Annual Meeting. He noted that some 18 engineering societies would occupy the 20-story building which is 283 ft high with 260,000 sq ft of floor space, gross; 18 stories of office space, and two of mechanical equipment. It is located on United Nations Plaza at 47th Street, the block between 47th and 48th Street. It is a slim tower of glass, stainless steel, and limestone rising from a broad two-story base of glass and stone. The ground for the $12-million structure was broken in October, 1959, by former President of the United States, Herbert Hoover. The architects were Shreve, Lamb & Harmon Associates, the structural engineers, Seelye, Stevenson, Value & Knecht; the mechanical and electrical engineers, Jaros, Baum & Bolles; and the general contractor, Turner Construction Company.

Mr. Larkin reported on the ASME Member Gifts Campaign: 30 Sections are 100 per cent of quota or better, eight sections are between 90 and 100 per cent, and about ten sections are between 80 and 90 per cent. He also reported that two letters were being sent; one a thank you note to those who contributed, and the other to those members who have not contributed, with an envelope where they can put a contribution in as impulse gift and forward it to headquarters. He concluded his report by announcing that an honor roll is being compiled, probably in a bound book form, which will become a permanent part of the Society's archives. He then called on E. J. Kates, ASME Treasurer.

Mr. Kates, representing the Oil and Gas Power Division of ASME, presented a check for $5000 from the Division for the Member Gifts Campaign. A contribution of a like sum was made by the OGP Division in 1959.

## Literature

*(Continued from page 98)*

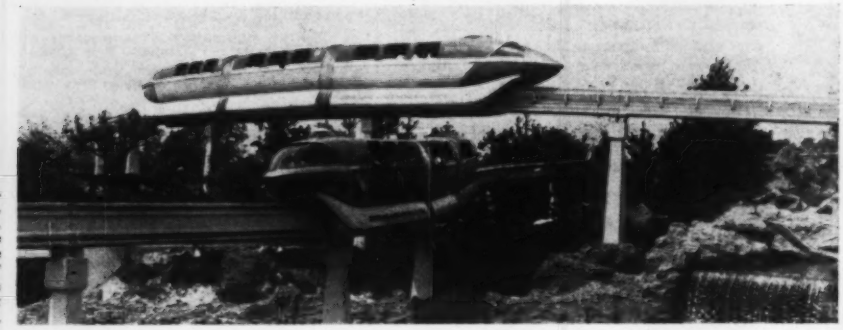
Prior to final publication, this report was reviewed by leading electrochemists, engineers, and businessmen. These critics expressed praise for the study which they believe presents authoritative conclusions and predictions concerning the economic future of the fuel cell.

Available from: Fuel Cell Research Associates, P. O. Box 157, Cambridge 39, Mass. Price: $18.75.

**Reactors.** "Reactor Handbook, Materials," vol. 1 of the four-volume Second Edition published by the Atomic Energy Commission, has been placed on sale. The volume covers solids, liquids, and gases, whereas the first edition had only solids. It has more than 1200 pages, and was prepared by 105 of the nation's foremost reactor scientists and engineers. The remaining three volumes of the set were scheduled to be published by spring, 1961. The first volume is available for $36.50 through Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y.

**Plant Maintenance and Engineering.** The eleventh volume of the annual

*(Continued to page 118)*



Alweg monorails at Disneyland. In this land of fantasy, you could go back to horsecars, or forward to a trip to the moon. You could take a common ordinary "submarine" ride. Twelve would be a wonderful age for seeing Disneyland: Other good ages are 36 and 99.

# Summer Annual. . . . West Coast is scene of the Society's final midyear

Just before the Management Luncheon. **Left to right:** D. D. Acker of North American Aviation, C. H. Shumaker of Southern Methodist University (who later became the Presidential nominee), W. H. Byrne, President ASME, Marshall Anderson of General Electric (as Chairman of the Management Division, he presided at the Luncheon), and Darrell Holmes, Executive Dean of San Diego State College, luncheon speaker. Dean Holmes spoke on psychological tests. His statement that 80 per cent of all failure is due to lack of interest drew a question: Can interest be stimulated? His experience seemed to suggest that the best solution is to shift the individual to another assignment. He cited a case in which a shift resulted in outstanding success.

THE Summer Annual Meeting of The American Society of Mechanical Engineers was held June 11–14, 1961, at the Statler Hilton Hotel in Los Angeles, Calif. This will be the last of the mid-year general meetings—in which technical sessions are held by many divisions. The march of technology has written an end to this traditional gathering of all the divisions: The division conferences take over. Henceforth, the Summer Annual Meeting will be a business meeting, bringing together the Council and the many committees which carry on the Society's work.

At Los Angeles, registration was just under 800, and the gathering of engineers heard technical papers from the following 13 of the Society's 26 divisions and groups: Automatic Control, Fuels, Heat Transfer, Human Factors, Machine Design, Management, Materials Handling, Nuclear, Petroleum, Process Industries, Production, Safety, and Solar Energy.

At the President's Luncheon, President William H. Byrne spoke on the Society's effort to improve its operations, the search for new ways to serve the membership. A condensation of this speech appears as a feature article in this issue of MECHANICAL ENGINEERING, pp. 38–39.

**Divisions in Session.** Panel sessions discussed topics so advanced that it is not yet time for technical papers. On the first day, there was a panel on one of today's hottest technical subjects: How to make cheaper electricity by eliminating conventional generators. Areas included fuel cells (in which chemical action of a burning fuel is used directly to make electricity, as in a chemical battery), generating electricity directly from sunlight, magnetohydrodynamics (MHD) generators, and thermoelectric and thermionic conversion.

Another panel session covered safety in the petroleum industry, emphasizing the mechanical engineer's responsibility to safety. This was sponsored by the comparatively new Human Factors Group in collaboration with the Human Factors Society. A later paper (not printed) from this group told of the revolution in dental equipment, how newly engineered dental instruments are bringing good news to toothache sufferers.

During a panel session the first afternoon, specialists spoke on how to use the potent forces of radioactivity in factory and laboratory without undue hazards. In all these panels, men spoke without formally prepared papers.

The Management Division, always active in general meetings of the Society, held a number of technical sessions, plus the traditional Management Luncheon. The management sessions offered a broad presentation of subjects—all the way from a philosophy of decentralized management, to factors behind business success, and into engineering matters bearing on the influence of production objectives on production costs, legal responsibilities of engineers, and selling engineering to management. These were not "how to" sessions; rather, they were philosophical in scope, concentrating on the business aspects.

**Young Men Coming Up.** A feature of the Summer Annual Meeting of long standing has been the student competition for the "Old Guard Prize," in which student engineers present technical papers before judges who decide the winner on a basis not only of technical content but on the skill of presentation. (Each contestant has already won the contest in his

Young man: Make engineering your career. Mrs. J. J. Marino reacts warmly to the announcement (at the banquet) that her husband has won the Old Guard Prize. A sidelight of the student competition is that older engineers who want to see how a technical paper should be presented can watch it done with great skill by the students. The young men are working against the clock—they must not run over their allotted time—and their platform performance has been perfected. A prime reason for the prize is to stimulate young engineers to become literate and self-assured in presenting their ideas.

"General Meeting." Assembled engineers are briefed on new methods of generating electricity. . .

The banquet table, Professor Frederick C. Lindvall speaking. **At the left,** Mr. and Mrs. V. A. Peterson (Mr. Peterson was toastmaster), President and Mrs. William H. Byrne, and J. Calvin Brown, past-president and Fellow ASME. Professor Lindvall's speech called on the profession to adapt to the swiftly changing technology. "Engineering education should be fundamental, viable, and transferable . . . with the flexibility to adapt to new situations and the vitality to evolve with the changing environment."

Region.) The Old Guard is a group of senior members who have been members so long that they are now "dues exempt," and they have put together their dues—and more—to post a certificate and a prize of $150 (plus the expenses of the winner in going to the Winter Annual Meeting and presenting his paper there). Winner this year was Joseph J. Marino of the University of Connecticut, Storrs, Conn., for his paper, "Considerations for the Design of an Ammonia-Phosphoric Acid Reactor."

**The Main Event.** Verne A. Peterson of Peterson Associates, Los Angeles, presided at the banquet. The main speaker was Frederick C. Lindvall, Chairman of the Division of Civil, Electrical, and Mechanical Engineering and Aeronautics of the California Institute of Technology, Pasadena, Calif. His subject was "Evolution in Mechanical Engineering," and what he said had a direct bearing on many of the points taken up by President Byrne. Are we adapting to the technological environment, or are we trying to maintain something which is archaic?

Mr. Lindvall traced the history of engineering, starting with the derivation of the word from the Latin *ingenium*—ingenious—through the age of the development of steam engines, to the nuclear age, stressing the overlapping of the disciplines and the need for more thorough mathematical grounding for student engineers.

He urged that ASME move in the direction of satisfying the interests of today's engineering students. He believes student intuition may be a better indication than we think.

He had a comment on the place of MECHANICAL ENGINEERING in the new engineering outlook.

"Students," he said, "are subjected to a great deal of sophisticated advertising and other forms of publicity dealing with the latest developments in aircraft,[1] missiles, space vehicles, communication, electronics, and so on. A glance through the advertising pages in MECHANICAL ENGINEERING gives an impression of boilers, valves, pipe and pipe fittings, bearings, blowers, pumps—none of which, however useful, is offered as a means of placing the first man on the moon."[2]

The Oil and Gas Power Division presented a check for $5000, their second gift to the building fund of the United Engineering Center, to Assistant Secretary W. H. Larkin. This gift had been authorized back in April, at the New Orleans Conference of Oil and Gas Power, bringing the total for the Division to $10,000. Other Divisions have made gifts in four figures, but none has approached the total of Oil and Gas Power.

**The World of Fantasy.** A delightful interlude was the trip, one night, to Disneyland—and don't think the assembled engineers didn't go, two busloads of them. You start off for Disneyland telling yourself, "I'm too old for this nonsense, but I'll go so I can tell the kids." Within the first hour you discover you're not too old. Mr. Disney has created no ordinary amusement park.

[1] Suggested reading: "Piloting the Jet Transports," MECHANICAL ENGINEERING, April, 1961, pp. 48–52, a discussion of the problems jet engines and swept wings presented to the transport pilot.

[2] Sophisticated advertisers can reach our Advertising Department at 29 West 39 Street, New York 18, N. Y.

**Left.** The Summer Annual Meeting offered the visiting engineers two trips to nearby plants. At Beckman Instruments, Inc., of Fullerton, Calif., Wayne Phillips, **second from right,** product-design manager for the Scientific and Process Instruments Division, shows a subassembly for a Beckman DK spectrophotometer. Beckman markets more than 400 different products with annual sales exceeding $60 million. Another trip took the visitors to a Ford plant where the output was 53 cars per hour—one shift per day.

**Lower Left.** The ladies also attended the Meeting, some 75 of them accompanying their husbands to the land of Disney. Mrs. Emil Lane, **left,** newly appointed Chairman of the Women's Auxiliary to the ASME, Southern California Section, shakes hands with Mrs. Ray Madison, the outgoing Chairman. **In the center** is Mrs. T. N. Graser, National President. The ladies' program, under the direction of Mrs. Madison, included trips to the historic San Fernando Mission, the Huntington Library and Art Gallery in Pasadena, and to the Palo Verdes area and the Oceanarium.

**Lower Right.** Up front at the Council Meeting. **Left to right,** the picture shows William H. Byrne, President ASME, T. A. Wetzel of Kearney & Trecker, Chairman of the Constitution and By-Laws Committee, O. B. Schier, II, **seated,** Secretary of ASME, and G. M. Muschamp of the Brown Instruments Div., Minneapolis-Honeywell, Chairman of the Subcommittee to Review the Constitution, By-laws, and Rules. **Closeup** is D. B. MacDougall, **left,** of the ASME staff, speaking to Past-President J. N. Landis.

## . . . Field Trips, Social Events, and Council Meeting at the **Summer Annual**

It is executed with the love and imagination that adds up to genius. It is a work of art.

**About the Summer Annual Meeting.** The next Summer Annual Meeting, June 10–14, 1962, will be held in Quebec, P.Q., Canada. It will be essentially a business meeting. One general meeting remains—the Winter Annual, to be held this year in New York, N.Y., November 26-December 1. Except for these great gatherings of the entire Society, MECHANICAL ENGINEERING becomes the one link by which the Society can keep its membership informed on the entire field of mechanical engineering. We can regret the decline of the general meetings but we cannot deny the trend toward specialization. We must serve a membership which is divided into compartments—the Technical Divisions—and the walls of those compartments grow higher with every year.

An availability list of papers presented at this meeting follows. Digests of all numbered papers which are not scheduled for publication in MECHANICAL ENGINEERING will appear in the "ASME Technical Digest" in a forthcoming issue of MECHANICAL ENGINEERING.

**Committees in Charge.** It takes a considerable company of dedicated people to manage a gathering of this size and have the scheduled events come off smoothly. The technical program is produced by the Professional Divisions and committees. But the luncheons, banquets, and other features which lend grace and solidarity to a meeting are in the hands of the Host Section—in this case, the Los Angeles Section. The following are the people whose efforts and leadership made this meeting a success:

*ASME Meetings Committee:* W. Burdette Wilkins, *Chairman;* Lester C. Smith; Kenneth L. Selby; T. S. Fetter, Jr.; Albert S. Goldstein; and Bernard A. Meany.

*Los Angeles Section Executive Committee:* J. E. Wolf, *Chairman;* R. L. Ridgway, *Vice-Chairman;* J. B. Moore, *Secretary;* and O. L. Lewis, *Treasurer.*

*Summer Annual Meeting Committees General Arrangements:* J. H. Goodell, *Chairman.*

*Technical Liaison:* F. H. Jennings, *Chairman.*

*Finance:* O. L. Lewis, *Chairman.*

*Hotel and Entertainment:* J. D. Schulz, *Chairman.*

*Reception:* Verne A. Peterson, *Chairman.*

*Plant Trips:* P. E. Christman, *Chairman.*

*Registration:* R. L. Ridgway, *Chairman.*

*Publicity:* J. E. Ekstromer, *Chairman.*

*Transportation:* Ray Madison, *Chairman.*

*Woman's Auxiliary to the ASME Los Angeles Section:* Mrs. Ray Madison, *Chairman.*

*Ladies' Program:* Mrs. William P. Winn, *Co-Chairman;* Mrs. Joseph C. Widmont, Jr., *Co-Chairman;* Mrs. F. Barton Brown; Mrs. Clay Colley; Mrs. Burnie Craig; Mrs. Charles Crede; Mrs. C. R. Freberg; Mrs. Robert L. Graham; Mrs. James E. Gugeler; Mrs. Emil Lane; Mrs. Ray S. Madison; Mrs. A. A. Mathewson; Mrs. Winchell M. Parsons; Mrs. J. R. Phares; Mrs. Robert L. Ridgway; Mrs. E. Kent Springer; Mrs. R. L. Thomas; Mrs. Edward Timbs; Mrs. W. M. Titchnell; and Mrs. J. E. Wolf.

Moment of triumph. A few seconds before this picture was snapped, the Secretary had announced from the banquet platform that Clifford H. Shumaker, Chairman of the Department of Industrial Engineering of Southern Methodist University, had been nominated for next President of ASME. Professor Shumaker is standing to thunderous applause.

## Availability List—Summer Annual Meeting

THE papers in this list are available in separate copy form until April 1, 1962. Please order only by paper number; otherwise the order will be returned. You can save the postage and handling charges by including you check or money order made payable to ASME with your order and sending both to the ASME Order Department, 29 West 39th Street, New York 18, N. Y. Papers are priced at 50 cents each to members; $1 to nonmembers. Payment also may be made by free coupons distributed annually to members, or coupons which may be purchased from the Society. Coupons, in lots of ten, are $4 to members; $8 to nonmembers.

### Automatic Controls

**61—SA-65** Aspects of Power-Plant Automation, by M. Birnbaum, G. Kotnick, and D. M. Sauter

**61—SA-66** Operations Research Study of Steam-Power Plant Automation, by J. K. Dillard and J. L. Everett

**61—SA-68** Field Testing for Verification of a Dynamic Model, by H. G. Dallas and D. M. Sauter

**61—SA-69** Dynamic Representation of a Large Boiler-Turbine Unit, by J. H. Daniels, M. Enns, and R. D. Hottenstine

### Fuels

**61—SA-49** The Use of Natural Gas in Open Hearths, by E. R. Gardner

**61—SA-53** Flame Stabilization in a Boundary Layer Over a Cooled Surface, by R. J. Heinsohn and J. E. Lay

**61—SA-54** Application of Burner Safety Supervise Control to Existing Gas-Fired Central Station Boilers, by C. J. Henne

**61—SA-56** Development of a Combination Liquid and Gas Fuel Burner System for Thermoelectric Generators, by L. Selwitz

**61—SA-59** Heat Transfer in an Infinite Tube-Supporting Surface Combustion, by D. Gidaspow and R. T. Ellington

### Heat Transfer

**61—SA-19** Measurements of Diabatic Flow in an Annulus With an Inner Rotating Cylinder, by K. M. Becker and J. Kaye

**61—SA-20** The Influence of a Radial Temperature Gradient on the Instability of Fluid Flow in an Annulus With an Inner Rotating Cylinder, by K. M. Becker and J. Kaye

**61—SA-23** Thermal Radiation Characteristics of Cylindrical Enclosures, by E. M. Sparrow, L. U. Albers, and E. R. G. Eckert

**61—SA-24** Velocity and Temperature Profiles in Turbulent Boundary Layers With Tangential Injection, by R. A. Seban and L. H. Back

**61—SA-25** Transient, Laminar, Combined Free and Forced Convection in a Duct, by S. L. Zeiberg and W. K. Mueller

**61—SA-26** Forced Convection Heat Transfer From a Uniformly Heated Sphere, by W. S. Brown, C. C. Pitts, and G. Leppert

**61—SA-27** Thermocouple Temperature Disturbances in Low Conductivity Materials, by J. V. Beck

**61—SA-28** Heat Transfer for Pulsating Laminar Duct Flow, by R. Siegel and M. Perlmutter

**61—SA-29** The Effect of Subcooled Liquid on Laminar Film Boiling, by E. M. Sparrow and R. D. Cess

**61—SA-30** Entrance Effects in a Two-Phase Slug Flow, by R. Moissis and P. Griffith

**61—SA-31** Analysis of Film Boiling on Vertical Surfaces, by J. C. Y. Koh

**61—SA-32** Laminar Flow Heat Transfer for Variable Physical Properties, by L. B. Koppel and J. M. Smith

**61—SA-33** The Development of Free Convection Between Heated Vertical Plates, by J. R. Bodoia and J. F. Osterle

**61—SA-34** Heat Transfer by Simultaneous Conduction and Radiation in an Absorbing Medium, by R. Viskanta and R. J. Grosh

**61—SA-44** Techniques for Optimization of a Finned-Tube Radiator, by L. H. Schreiber, R. P. Mitchell, G. D. Gillespie, and T. M. Olcott

### Machine Design

**61—SA-1** Surface Durability Ratings of Spiroid Gears, by W. D. Nelson

**61—SA-2** Constant Diameter Cams, Their Properties and Design Characteristics, by K. Brunell

**61—SA-3** On the Variety of Motions Generated by Mechanisms, by F. Freudenstein

**61—SA-4** Synthesis of Rectilinear Motion by Mechanical Harmonic Function Generators, by B. W. Shaffer and I. Krause

**61—SA-5** The Superposition of Stress Concentration Factors, by F. W. Paul, Jr., and T. R. Faucett

**61—SA-14** Maximum Stresses in Beams and Plates Vibrating at Resonance, by E. E. Ungar

**61—SA-15** Thermal Stresses in Spherical Case-Bonded Propellant Grains, by I. Krause and B. W. Shaffer

**61—SA-55** Zero-Shift in Galvanometers Subjected to Mechanical Vibration, by D. A. Conrad and D. G. Shellhorn

**61—SA-67** On the Kinematics of Rubber-Covered Cylinders Rolling on a Hard Surface, by G. N. Sandor

### Materials Handling

**61—SA-8** The Automation of a 40,000 Ton Per Day Ore-Handling Facility, by C. M. Marquardt

**61—SA-9** Pitfalls in Air Conveying, by D. L. Burrell

**61—SA-10** A One Man Boom Hoist System for Handling Citrus Fruit, by R. J. Smith and R. L. Perry

**61—SA-11** Tensions in Straight and Curvilinear Belt Conveyers, by W. A. Winkler

**61—SA-16** The Development of Protective-Handling Systems for High-Reliability Components and Systems, by G. A. Peters

### Management

**61—SA-61** Creating Creativity in Your Employees, by A. L. Logan

**61—SA-62** Selling Engineering to Management, by D. E. Farr

**61—SA-63** Engineering Malpractice, by I. L. Tunis

**61—SA-64** The Influence of Development Objectives Upon Production Costs, by D. K. Richardson

### Nuclear Engineering

**61—SA-39** Design and Testing of Sodium Pumps for the Hallam Nuclear Power Facility, by R. E. Ball, D. E. Cullman, and R. W. Atz

**61—SA-41** Design of Reliable and Economical Heat Exchangers for High-Temperature Sodium Service, by R. D. Seifert and L. E. Phillips

**61—SA-42** Compact Reactor Development for Ground Nuclear Power Applications, by M. A. Rosen, T. W. McIntosh, and R. A. Du Val

**61—SA-43** The ML-1 Mobile Nuclear Power Plant, by S. A. Varga, R. K. Swain, and J. C. Whipple

**61—SA-46** Testing of a 3000-Kw (Th), Liquid-Metal, Model Steam Generator, by L. J. Webster, D. E. Fletchall, and D. Logan

**61—SA-52** Summary of Snap Nuclear Space Power Systems, by E. B. Baumeister

**61—SA-57** Erection and Precritical Testing of the NS Savannah Power Plant, by C. W. Hasek, Jr.

### Petroleum

**61—SA-12** Simulation of the Gas Transmission Industry, by E. Gordon

**61—SA-13** A New Approach to Digital Computer Solution of Gas Networks Based on Kirchhoff's First Law, by M. A. Dengler and J. P. Siken

**61—SA-17** Effect of Prestrain on the Fatigue Properties of Steel, by J. F. Gormley

**61—SA-18** Press Forming and Welding of Heavy Magnesium Plate, by R. A. Matuszeski and A. J. Kish

**61—SA-36** Protection of Cooling-Water Piping Systems Against Seawater Corrosion, by J. Goudriaan

**61—SA-40** A Comparison of United States, European, and British Commonwealth Codes for the Construction of Welded Boilers and Pressure Vessels, by J. F. Lancaster

**61—SA-50** Engineering Considerations in Drilling From a Floating Vessel, by R. F. Bauer

**61—SA-51** Use of Hard Carbide Components in Petrochemical Processing, by W. L. Kennicott

**61—SA-58** A New Look at Pressure Vessel Testing, by C. E. Lautzenheiser and F. B. Crouch, Jr.

**61—SA-60** Fabrication Requirements for Balanced Classes of Piping, by H. S. Peterson and C. H. Voelker

### Process Industries

**61—SA-21** Cyclic Processes in Closed Regenerative Gas Machines Analyzed by a Digital Computer Simulating a Differential Analyzer, by T. Finkelstein

**61—SA-22** An Axial-Flow Porous Plug Apparatus, by R. C. King and J. H. Potter

**61—SA-35** Inertial Impaction in Cyclone Separators, by M. H. Binark and S. P. Patel

**61—SA-47** Saturated Steam Reheater Applied in New Nuclear Power Station, by F. W. Gettler, Jr., and J. H. Potter

**61—SA-48** Closed Loop Control by Gas Chromatography, by E. E. Escher

### Production Engineering

**61—SA-6** Forming, Trimming, and Edge Finishing of Molybdenum-0.5 Per Cent Ti Sheet Material, by A. L. Pickrell

**61—SA-7** Machinability of Nodular Cast Irons, Part 2, Effect of Cutting Conditions on Flank Adhesion, by K. Hitomi and G. L. Thuering

### Solar Energy Applications

**61—SA-37** Solar Distillation Research at the University of California, by E. D. Howe and L. H. MacLeod

**61—SA-38** Performance of a Solar Still, by C. R. Garrett and E. A. Farber

**61—SA-45** New Applications of Thermodynamic Principles to Solar Distillation, by W. N. Grune, T. L. Thompson, and R. A. Collins

# 1961 REGIONAL ADMINISTRATIVE COMMITTEE MEETINGS

DURING March, April, and May each of the ten Regions conducted its Regional Administrative Committee Meeting. The main objective of the RAC Meeting is to provide a forum with the Vice-President on Regional and Society operating problems. The meeting also affords an opportunity to express the views of the Region on the National Agenda as well as to provide a conference for the representatives of Sections to further the nominating procedure for national offices.

The Vice-President of the Region serves as Chairman of the RAC and his Regional Secretary as Secretary. Each Section in the Region sends two representatives, one of whom is usually the current Chairman. In addition to the Section representatives, there are usually present at each RAC meeting the various Regional Committee Chairmen.

Each of the Regional Administrative Committees elects annually a junior delegate to go to the Regional Delegates Conference for two years. The RDC is held in conjunction with the Summer Annual Meeting of the Society—with each Region sending a senior and junior delegate. The principal business of the RDC is to act on the consolidated list of Agenda Items which have received the approval of three or more Regional Administrative Committees

The present procedures have evolved from long experience.

**Region 1, Waterbury, Conn.**

**Front Row, left to right,** Mrs. Alexander Hammer, Mrs. Kenneth Barnhill, Mrs. T. N. Graser, Mrs. W. H. Byrne, Mrs. A. F. Green, Miss C. E. Bachand, and Mrs. C. H. Coogan, Jr.
**Second Row,** C. H. Coogan, Jr.; W. H. Byrne; O. B. Schier, II; and Alexander Hammer.
**Third Row,** W. P. Chaisson, G. S. White, L. J. Brancato, R. E. Roberts, W. P. Berggren, and D. G. Hanefeld.
**Fourth Row,** Earle Miller, C. G. Parker, J. M. O'Byrne, R. B. Parker, and K. G. Barnhill.
**Fifth Row,** A. S. Morton, J. R. Canal, T. H. Keel, and Mead Bradner.
**Sixth Row,** J. O. Outwater, T. N. Graser, C. A. Renfrew, E. B. Perry, S. G. Merra, R. D. Ambercrombie, and A. F. Green.
**Seventh Row,** Richard Neuendorffer; J. W. Swan; Frank Catudal; H. W. Carlson; H. M. Rogers, Jr.; R. W. Boyle; N. B. Greene; and F. J. Zimmermann.

**Region II, Suffern, N. Y.**

**Front Row, left to right,** J. L. O'Neill, J. T. Tambini, B. G. Schieber, John Mihalasky, Thomas Reinauer, and J. T. Reid.
**Second Row,** L. J. Schmerzler, A. M. Perrin, G. B. Thom, W. H. Byrne, G. R. Hahn, W. B. Moen, and D. B. MacDougall.
**Third Row,** Edward Miller, U. A. Rothermel, C. R. G. Dougherty, E. S. Bance, P. T. Paraskevas, J. R. Muenger, R. K. Bryant, J. T. Vollbrecht, H. F. Kelly, and Charles Colangelo.
**Top Row,** R. E. Abbott; William Lyons; F. L. Bradley, Jr.; John Campbell; Nino Addonizio; Karl Vindler; R. J. Pecora, Jr.; C. J. LaPolla; B. A. Meany; H. H. Johnson; and C. T. Oergel.

**Region III, Lancaster, Pa.**

**Front Row, left to right,** J. W. Sawyer; C. A. Aronson; W. E. Belcher, Jr.; R. LaFramboise; W. C. Franklin; R. N. Skalwold; W. G. McLean; T. S. Fetter, Jr.; A. E. Mall; and J. H. Hollyday.
**Second Row,** J. E. Thompson, Jr.; V. Pence; D. D. Taylor; M. B. Hogan; D. E. Marlowe; W. H. Byrne; O. B. Schier, II; P. E. Bissonnette; N. P. August; and J. D. Paulus.
**Third Row,** J. W. Ott; F. A. Lang; G. E. Rosenberg; J. A. Cunningham; M. J. Spruitenburg; T. Howitt, Jr.; W. H. Attwill; A. F. Bochenek; K. E. Bisshopp; F. Mehringer; and A. J. Westbrock.
**Back Row,** J. H. Palmer, J. T. Evans, W. R. Shade, L. D. Conta, L. B. Wilder, M. Dykman, F. W. Kuehn, H. E. Johnson, A. D. Brickman, W. H. Park, and J. Hollis.

**Region IV, Atlanta, Ga.**

**In the photo that wasn't there at press time,** R. C. Robertson, E. E. Burroughs, J. W. Little, J. F. Bailey, K. T. Knight, W. A. Snellgrove, F. A. Iachetta, H. K. Couch, C. M. Irwin, Jr.; Arthur Croll, G. B. DeHoff, Erskine Vandegrift, Jr.; M. A. Carter, George Brengelman; R. E. Williams, Jr.; L. M. Parker; E. G. Coursey; E. C. Taylor, Art Temple; J. C. Campbell; Robert Tulis; H. P. Reinhart; W. R. Crabtree; R. S. Anderson; H. G. Duggan; Roscoe Meadows, Jr.; R. L. Girourd; T. B. Kimball; F. R. Crowley; J. L. Edwards; C. R. Hatch, Jr.; T. J. Judge; R. B. Bevan; E. H. O'Neal; W. B. King; C. E. Thies; Howard McGill; C. S. Howland; H. E. Broward; T. C. Barnes, C. M. Irwin, Jr.; L. B. Connor; W. J. Karrh; M. B. Crotts; Joe Powell; A. L. May, Jr.; E. W. Boggs; G. R. Carr; L. W. Holmes; J. B. Jones; W. H. Byrne; and O. B. Schier, II.

**Region V, Dayton, Ohio**

**Front Row, left to right,** E. C. Pandorf, J. H. Doughtery, R. L. Holloway, C. L. Tutt, Jr., E. W. Allardt, H. N. Muller, Jr., W. H. Byrne, O. B. Schier, II, R. Nelsen, H. M. Cather, D. Schild, and G. Linsker.
**2nd Row,** J. A. Brown, W. G. Cornell, J. Kurlej, O. W. Nichols, P. H. Baker, A. C. Hotopp, W. J. Titzell, W. N. Cooper, J. H. Hall, G. E. Pankratz, D. R. Fruchte, R. H. Zimmerman, J. W. Roeder, M. Bezbatchenko, and J. E. Davies.
**3rd Row,** W. S. Grist, J. W. Mitchell, A. D. Hogg, W. H. Lowry, W. Forstall, Jr., D. J. Beecher, H. H. Hauth, J. H. Kline, J. L. Hole, E. R. Braun, D. E. Hart, M. L. Smith, R. E. Tyner, R. R. Hayes, R. F. Iager, and O. H. Maier, Jr.

**Region VI, Louisville, Ky.**

**Front row, left to right,** H. B. Ratcliff; M. A. DeCicco; E. W. Jerger; D. B. Kececioglu; O. B. Schier, II; D. J. Bergman; T. J. Dolan; R. T. Mees; R. G. Henneman; T. L. Kick; J. E. Johnson; and R. B. Gallagher.
**Second Row,** C. A. Davis; E. LaCrosse, Jr.; R. S. Coburn; M. A. Keefer, Jr.; E. J. Carraro; S. Close; A. G. Friederich; E. R. Friesth; K. E. Schlundt; V. N. Tramontini; E. F. Ryden; H. Schauberger, Jr.; and R. M. Haragan.
**Third Row,** L. A. Horlander, S. P. Kezios, W. H. Lebo, M. J. Moseley, G. A. Rice, E. P. Larson, T. R. DuBois, H. C. Davidson, P. S. Webber, E. I. Mendenhall, G. Richardson, and R. J. Harker

**Region VII, Kansas City, Mo.**

**Front Row, left to right,** Lee Warren; George Herring; P. K. Harris; R. Benninghoven; Harold Grasse; O. B. Schier, II; Harry McPherson; James Rudolph; and Charles Maccietto.
**Middle Row,** L. A. Block; K. E. Johnson; Larry Platt; Robert Mills; B. G. Barr; Robert DeCamp; Herbert Jespersen; E. A. Swanson; Robert Russell; and Robert Harold.
**Top Row,** Frank Vinella; Merle Jansen; Dean Chenoweth; F. A. Slief; Conway Briscoe; Ralph Scorah; John Buss; William Oonk; and Wayne Sieverding.

**Region VIII, Denver, Colo.**

**Front Row, left to right,** Milton Thacker; J. McKiernan; C. H. Shumaker; W. H. Byrne; E. H. Draper; O. B. Schier, II; Art Clark; and G. C. McDonald.
**Second Row,** R. B. Stewart; D. R. Wilson; John Parmakian; R. D. Baker; Fred Wahlquist; Warren Kohler; R. L. Sutherland; R. J. Williams; and Henry Mattson.
**Third Row,** John Simonsen, W. E. Reaser, Don Williams, Joe Rivard, E. K. Gardner, W. K. Sutherland, Tom Taxelius, Martin Trillhaase, and C. H. McCabe.

**Region IX, Seattle, Wash.**

**Front Row, left to right,** O. B. Schier, II; A. J. Dempsey; W. C. Heath; W. H. Bryne; R. H. Meleney; and M. Guidon.
**Second Row,** Vern Hill, Danny Marinos, Robert Waldon, and H. E. Christensen.
**Third Row,** H. S. Aurand, M. Popovich, A. K. Ingraham, C. A. Redfern, Ray Boals, C. J. Fryer, R. L. Ridgeway, and J. W. MacPherson.
**Back Two Rows,** B. T. McMinn, H. J. Bentson, D. E. Ott, P. J. Swanson, J. D. Pugel, F. G. Chilton, M. E. Davy, E. B. Day, G. E. Kidd, H. A. Lindbolm, Ray Murphy, Bruce Wong, J. B. Moore, and Robert Beach.

**Region X, Tulsa, Okla.**

**Front Row, Seated at Table, left to right,** C. H. Shumaker, W. H. Byrne, A. H. Jensen, R. W. Cox, and O. B. Schier, II.
**Second Row, Standing,** B. L. Abbott, F. Quin, G. J. Groh, E. H. Pavia, D. E. Regenbrecht, M. Alejandre, L. Zoller, R. Critz, B. D. Howell, D. C. Pheiffer, and A. E. Emmett.
**Third Row, Standing,** R. B. Robertson, E. Stravolemous, C. M. Simmang, D. E. Hale, G. A. Tomlinson, R. Shannon, F. A. Thomas, Jr.; D. E. Marquis, D. E. Cunningham, J. M. Zilboorg, P. S. King, H. R. Sharp, and R. A. Best.

## REGION I

## REGION II

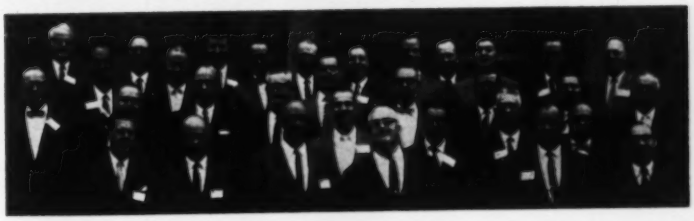
REGION III

REGION V

REGION VI

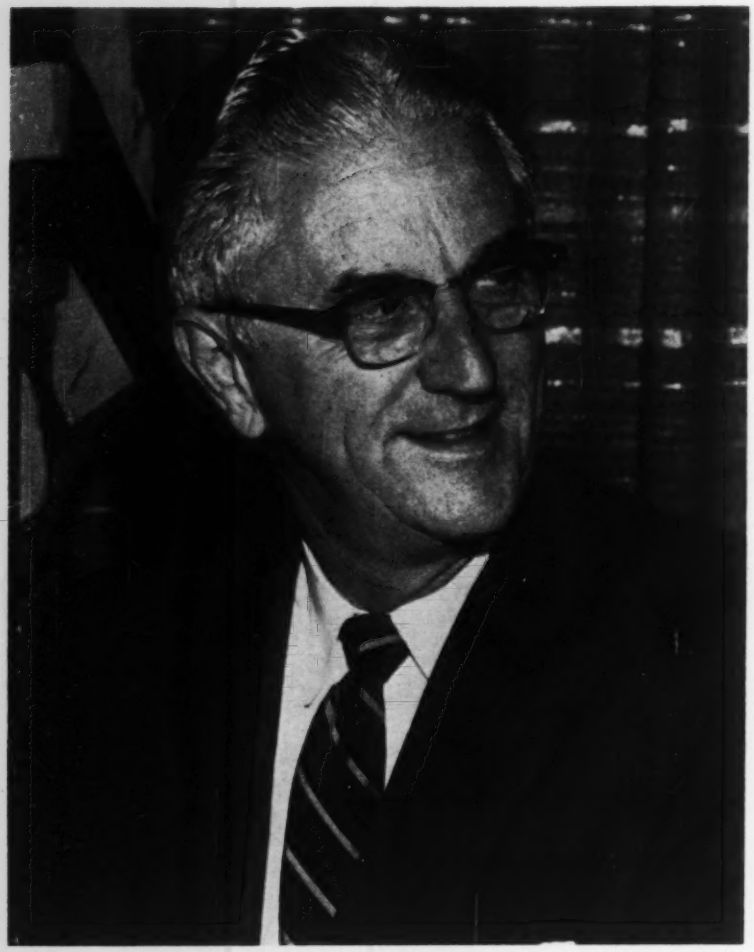
REGION VII

REGION VIII



REGION IX

REGION X



# C. H. Shumaker Nominated for 81st ASME President

## ASME Officers Nominated

DURING the 1961 Summer Annual Meeting of The American Society of Mechanical Engineers in Los Angeles, Calif., June 11–14, Clifford H. Shumaker, professor of mechanical engineering at Southern Methodist University, Dallas, Texas, was nominated by the National Nominating Committee to be the eighty-first President of the Society.

Regional Vice-Presidents named by the Committee to serve on the Council of ASME were: Edward H. Walton, Region I; Robert W. Worley, Region III; Robert Nelsen, Region V; Niles H. Barnard, Region VII; Emmett E. Day, Region IX; and Thomas J. Judge, Region XI.

Directors named by the Committee to serve for a four-year term included the following: Ernst W. Allardt of Alliance, Ohio; George M. Muschamp of Philadelphia, Pa.; and John Parmakian of Denver, Colo. Robert C. Allen, named to serve for two years, will complete the unexpired term of W. H. Larkin who was recently appointed to the ASME staff.

Members of the Committee making the nominations were: W. E. Belcher, Jr., Chairman, Region III; J. R. Muenger, Secretary, Region II; and C. G. Parker, representing Region I; Erskine Vandegrift, Region IV; R. L. Hollaway, Jr., Region V; E. W. Jerger, Region VI; D. B. Chenoweth, Region VII; R. B. Stewart, Region VIII; J. W. MacPherson, Region IX; R. G. Critz, Region X; N. J. Hoff, *Technological;* Z. R. Bliss, *Codes and Standards;* and F. K. Mitchell, *Administrative.*

Election of ASME Officers will be held by letter ballot of the entire membership, Sept. 28, 1961.

Brief biographical sketches of the nominees for office follow on the succeeding pages.

## Clifford H. Shumaker

CLIFFORD HAROLD SHUMAKER, educator and professional mechanical engineer, is the 1961 nominee for President of The American Society of Mechanical Engineers. Mr. Shumaker combines an interesting professional record with thorough experience in ASME regional and national activities, having served the Society since 1938, when he joined as an associate member.

He has been associated with Southern Methodist University since 1930, when he began his career there as an instructor in mechanical engineering, and has greatly contributed to its growth. He has been chairman of the university's department of industrial engineering since its establishment in 1952, when he was responsible for organizing its curriculum and faculty. Since 1948 he has been the director of the Institute of Management, a division of SMU jointly established in that year by the University and the Texas Manufacturers' Association for the purpose of training management personnel. He was president for 1957 of the Southwestern Council on Education for Business Responsibility in the states of Texas, Louisiana, and Oklahoma. Through this organization and other means, he has helped to increase industrial opportunities in the Southwest.

Mr. Shumaker was born in St. Joseph, Mo., on Oct. 25, 1907. He received his education at the University of Kansas, where he earned a BS in Industrial Engineering in 1930, and the degree of Mechanical Engineer in 1944. In 1933, after three years as an instructor at SMU, he left the academic trail to take charge of an industrial survey of Kansas as a research assistant for the Kansas State Planning Board, Topeka. In 1936, after two years with the engineering consulting firm of Paulette and Wilson, Salina, Kan., he returned to SMU as an assistant professor, successively becoming associate professor in 1941 and professor of mechanical engineering in 1945.

A leader in many SMU projects, he directed the War Training Program there from 1941 to 1945; the Ordnance Gage Laboratory from 1946, when it was established on the campus, to 1951; and the Institute of Building Material Distribution. In the War Training Program he organized and directed the training of more than 20,000 industrial workers. In 1951 he was a consultant to the U. S. Office of Education, conducting a survey of training needs in the Fort Worth-Dallas area.

Mr. Shumaker became a member of ASME in 1941 and a Fellow in 1960. He was Vice-President of Region VIII from 1953 through 1958, and was regional secretary from 1947 to 1953. On the national level, he has served as a member of the Organization Committee and chairman of the Program Committee of the Management Division; and as a member of the Committee on Staff Personnel, the Medals Committee, and the Council. He was chairman of the North Texas Section from 1947 to 1949. He has received the ASME Certificate of Award, and the ASME 75th Anniversary Medal. He has authored articles that appeared in MECHANICAL ENGINEERING, *Southern Power and Industry*, and *Consulting Engineer*. He is a member of the American Society for Engineering Education, the American Institute of Industrial Engineers, and Sigma Tau, and is a recipient of the Sigma Tau Medal. He is a registered professional engineer in Texas.

# Nominated for Vice-President

## Edward H. Walton

EDWARD HAVILAND WALTON, who has been nominated to serve for a two-year term as Vice-President of The American Society of Mechanical Engineers, Region I, is vice-president of engineering at The United Illuminating Company, New Haven, Conn.

Mr. Walton was born on Jan. 3, 1913, in New Rochelle, N. Y. In 1933 he was graduated with a BS in Civil Engineering at Swarthmore College and the following year went to work as a draftsman at Gibbs and Hill, New York, N. Y. From 1935 to 1939 he was an engineer with the American Radiator Company, New York, and then went with The Babcock & Wilcox Company. He joined the United Illuminating Company in 1942.

Active in ASME, where he has been a member since 1944, Mr. Walton has been chairman of the New Haven Section; secretary of Region I; and chairman of the National Agenda Committee and the National Civic Affairs Committee.

He is a member of the American Institute of Electrical Engineers and the Connecticut Society of Civil Engineers, and is a registered mechanical engineer in the states of New York and Connecticut.

## Robert W. Worley

ROBERT WILLIAM WORLEY, senior power engineer, United Engineers & Constructors, Inc., Philadelphia, Pa., has been nominated to serve for a two year term as Vice-President of The American Society of Mechanical Engineers, Region III. He was born in Canton, Ohio, June 21, 1903, graduated from Case Institute of Technology with a BS in Mechanical Engineering in 1924, and received his ME degree from Case in 1928.

Upon graduation, Mr. Worley was employed by the Ohio Power Company and the parent company, then the American Gas & Electric Company, until 1928, when he joined the plant-engineering staff of Delco Remy Division of General Motors Corporation at Anderson, Ind.

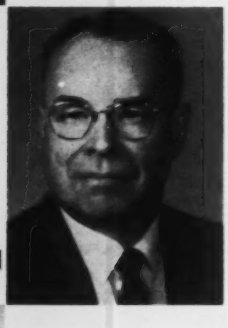
In 1941 he became associated with the power-engineering department of United Engineers & Constructors Inc., in Philadelphia. In 1944 he resigned to become chief engineer of the Union Drawn Steel Division, Republic Steel Corporation in Massillon, Ohio, for a period of 20 months. He returned to United Engineers & Constructors, Inc., in September, 1945, where he has remained to the present date. He is registered as a professional engineer in 16 states.

Mr. Worley's activities in ASME started at the Case Student Section in 1921. Upon graduation, he transferred to Junior Member, and in 1938 became a Member of the Society. He was active in the Central Indiana Section from 1938 to 1941, serving as chairman of several committees and as vice-chairman of this section. In 1941 he transferred to the Philadelphia Section. He has been an active member serving as chairman of most of the committees, and as director, treasurer, secretary, and vice-chairman. He served as chairman of the Philadelphia Section from July 1, 1952, to June 30, 1953. For three years, he attended the Region III Agenda Committee meetings and was appointed to the Regional Delegates Conference as Region III Alternate Delegate in 1953 and Region III Delegate and Vice-Speaker in 1954. In 1956–1957, he served as a member of Region III, Student Section Committee. Mr. Worley was general chairman of arrangements for the ASME Annual Meeting at Atlantic

E. H. Walton

R. W. Worley

Robert Nelsen



N. H. Barnard

E. E. Day

City, N. J., in 1959. He has served on the Professional Practice Committee of the Society as one of the original members, and is presently a member of the Engineers Registration Committee. He is at present the ASME representative on the National Bureau of Engineering Registration.

He is a member of Tau Beta Pi, Sigma Xi, Association of Iron and Steel Engineers, and the Philadelphia Engineers Club. He has presented papers at both ASME and AISE meetings. His present most active hobby is amateur radio, through which he has participated in providing communications for the Civilian Defense and Red Cross emergency corps.

## Robert Nelsen

Robert Nelsen, who has been nominated to serve for a two-year term as Vice-President of The American Society of Mechanical Engineers, Region V, is manager of Product Support Publications for the General Electric Company's Large Jet Engine Department at Cincinnati, Ohio.

Born in Homer, Neb., in 1920, he entered South Dakota State College, Brookings, S. D., in 1939, to study mechanical engineering. He received his BSME in 1947 after a war interruption in which he served from 1942 to 1945 as a pilot with the United States Air Force. He reactivated the Student Section of ASME at South Dakota State after the war, serving as chairman and then secretary. Mr. Nelsen was a member of Blue Key and was listed in the 1946 issue of "Who's Who Among Students in American Universities and Colleges." He won an "Old Guard" prize in the student paper competition at the University of Minnesota in 1947.

After graduation, Mr. Nelsen took a position with General Electric at Lynn, Mass., first in development testing of aircraft gas-turbine engines and then in production engineering. While at Lynn, he served as secretary-treasurer of the Boston Section of ASME.

He transferred to GE's Cincinnati jet engine plant in 1951 and has been head of Product Support Publications, responsible for the publication of service manuals related to jet engines, since 1955.

Mr. Nelsen is also national chairman of the Service Publications Committee of the Aerospace Industries Association this year.

Long active in ASME affairs, he was chairman of the National Junior Committee in 1954 and a member of the National Nominating Committee in 1958. He is secretary of Region V and past-chairman of the Cincinnati Section. He transferred to junior member upon graduation and to member in 1955.

He is also a member of the Society of Automotive Engineers, the Society of Technical Writers and Publishers, the Engineering Society of Cincinnati, and the Technical and Scientific Societies Council of Cincinnati. He is a registered professional engineer.

## Niles H. Barnard

Niles Hutton Barnard, who has been nominated to serve for a two-year term as Vice-President of The American Society of Mechanical Engineers, Region VII, was born Sept. 2, 1903, in Chicago, Ill., where he was graduated from high school in 1920. He delayed continuing his education until 1924 when he entered the College of Engineering at the University of Illinois. The four years between high school and college were spent in the South Works, Illinois Steel Company, and the Mechanical Department of the Illinois Central Railroad. Good advice from friends stimulated his college career.

At the University of Illinois Mr. Barnard received a BS in Railway Mechanical Engineering in 1928 and was appointed a research graduate assistant for two years in the Experiment Station. An MS degree was obtained in 1930 and during that two-year period Barnard took part in road-test work on feedwater heaters on the Illinois Central Railroad and in laboratory tests on thermic syphons in the firebox of Mikado-type locomotives on the test stand at the campus.

For five years, 1930–1935, Mr. Barnard was an associate professor of mechanical engineering at Tennessee Polytechnic Institute at Cookeville, Tenn., where he designed and built several laboratories for use in a newly formed engineering program. While here, he worked on his professional ME degree and received it from the University of Illinois in 1934. In 1935 he moved to Nebraska and joined the mechanical engineering staff at the University of Nebraska, working in the field of processing and first courses in management. He has been at Nebraska since that time save for a 15-month interlude during which time he worked professionally for The Methodist Church in developing Men's Clubs. Mr. Barnard's progress at Nebraska has been through the academic ranks to the present rank of professor and assignment

as chairman of the department of mechanical engineering since 1948.

Mr. Barnard became a junior member of ASME in 1930 and was advanced to member in 1937. His activities in the Nebraska Section have been divided between the Section and the Student Section on the campus. Section leadership consisted of membership on the Executive Committee, 1936–1942, and 1947–1950; RAC delegate, 1939 and 1940; and chairman of Section, 1939–1940 and 1949-1950. Until recently he has been representative of the Section on the Board of the Nebraska Engineering Society. In April, 1961, he was named president-elect of the Nebraska Engineering Society and will take office in April, 1962. Student Section leadership, besides that of a department chairman, found Barnard as adviser, 1936–1939, 1941–1944, 1948–1951, and 1952–1955. Since 1950 he has served as one of ASME representatives on the ECPD Inspection Committees.

Other engineering societies to which Mr. Barnard belongs are the American Society for Engineering Education, member of Council 1955–1957; American Society for Quality Control, Fellow, and member, Brumbaugh Award Committee, 1956 to date; Nebraska Engineering Society; Engineer's Club of Lincoln, past-president. He was elected a member of Tau Beta Pi and an associate in Sigma Xi while in school and has received honorary membership in Pi Tau Sigma and Sigma Tau.

Mr. Barnard is a registered engineer in Nebraska. He has taken part in short courses and industrial conferences at the University of Nebraska, the University of Illinois, and the State University of Iowa.

His further activity involves membership and offices in the American Interprofessional Institute and the American Association of University Professors.

## Emmett E. Day

Emmett Elbert Day, professor of mechanical engineering, has been nominated to serve for a two-year term as Vice-President of The American Society of Mechanical Engineers, Region IX.

Mr. Day was born in Paris, Texas, on July 21, 1915, and was educated at East Texas State Teachers College, where he received a BA in 1936, and at Massachusetts Institute of Technology, where he earned a BS in 1945 and an MS in 1946, both in mechanical engineering. An instructor since 1936, when he taught in the public schools of San Antonio and Houston, Texas, he became president of the San Antonio Vocational and Industrial Arts Teachers' Club in 1939, vice-president of the San Antonio Teachers' Council in 1940, and president of the Junior School Division of Alamo District of the Texas Teachers' Association.

After receiving his BS in 1945, he taught mechanical engineering at Massachusetts Institute of Technology until 1947, and then went to the University of Washington, Seattle, Wash., where he has remained. He became assistant professor there in 1948, associate professor in 1950, and professor in 1954. He spent his summers doing consulting and research work for various companies, among them the Boeing Airplane Company, Seattle; the Naval Research Laboratory, Washington, D. C.; and Chance Vought Aircraft, Dallas, Texas. He is a registered professional engineer in the State of Washington.

Mr. Day was an associate member of ASME in 1946, becoming a member in 1949. In serving the Society, he has held membership on many committees and was secretary of Region VII from 1956 to 1958. He was a member of the National Nominating Committee, 1959–1960; chairman of Region IX Membership Development Committee, 1960–1961; and chairman of its Student Relations Commitee, 1954–1956. He is local chairman of the 1961 West Coast Applied Mechanics Conference. His earlier service to ASME included chairmanship on the Technical Events Committee for the National Spring Meeting in Seattle in 1952; main speaker at the Member-Student luncheon during the New York Annual Meeting in 1954; membership on the Executive Committee and chairmanship of the Western Washington Section, 1953–1954. He was delegate to the Regional Administrative Conference for Region VII from 1952 to 1957. In 1954 ASME awarded him the Pi Tau Sigma Gold Medal Award.

He also is a member of the Society for Experimental Stress Analysis, Northwest Scientific Association, American Society for Metals, American Welding Society, Sigma Xi, and the American Society for Engineering Education. From 1953 to 1956 he was editor of the *Machine Design and Manufacturing Bulletin*, published by the Mechanical-Engineering Division of ASEE.

At the University of Washington, he has been a member of the committees on adult education, honors, and scholarships, and the Engineering College Committee on Curriculum Evaluation and Revision. Since 1948 he has supervised the University's Research Machine Shop and various laboratory facilities, and is a member of the University of Washington Research Society.

## Thomas J. Judge

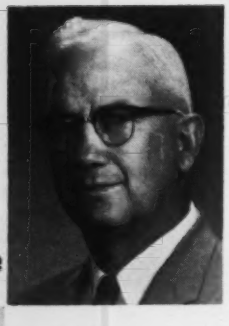
Thomas Jackson Judge, who has been nominated to serve a two-year term as Vice-President of The American Society of Mechanical Engineers, new Region XI, is at present division power engineer and co-ordinator of power plants for the Southern Kraft Division of International Paper Company, Mobile, Ala. He was born Feb. 18, 1908, in Wayne County, Miss.

He attended high schools in Clark County, Miss., and was graduated from Georgia Institute of Technology in 1934 with a BS degree in Electrical Engineering. While attending Georgia Tech as a co-op student, he worked with Westinghouse Electric Corporation on erection of equipment in various southern locations. Upon graduation, and for the ensuing eight years, he worked with Westinghouse as a steam service engineer in Atlanta, Ga. During this time, he was office service correspondent and did considerable field work pertaining to inspection, repairs, and installation of power-plant equipment.

In 1942 Mr. Judge was called to active duty with the U. S. Army, Ordnance Department. During a three-year period, he was assigned to the Safety and Security Branch, Office Chief of Ordnance in Washington, D.C., then as Officer in Charge of Installation of Ordnance Material in Seacoast Fortifications, and Officer in Charge of Seacoast and Antiaircraft Carriage Sub-Office of the Office Chief of Ordnance. He was discharged in 1945 as a Major.

Upon leaving the service, Mr. Judge became affiliated with the International Paper Company as assistant power-plant superintendent at the Louisiana Mill, Bastrop, La. He held this position until 1947 when promoted to his present position.

Mr. Judge has taken an active part in Society affairs at national and regional levels as well as Section. He became a member of ASME in 1948. He was instrumental in the organization of the Gulf Coast Subsection in 1954 and served as the first chairman. His Section activities include participation on the Executive Commitee, 1955 to 1958; the Civic Activities Commitee, 1959; and the Program Committee, 1960. Mr. Judge was RAC Delegate from the Gulf Coast Section in 1961. He served on the Regular Nominating Committee as an alternate in 1956 and a member



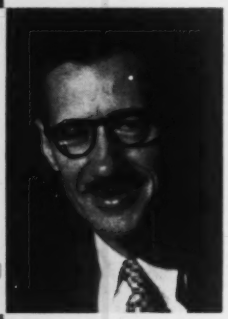
T. J. Judge

in 1957. From 1954 to 1957, he was a member and chairman of the Region IV Student Section Committee. At present, Mr. Judge is a member of the Power Test Codes Committee; the Power Division, Advisory Committee; and ECPD Mechanical Engineering Accreditation Inspection team.

Throughout the past several years, Mr. Judge has been quite active in the preparation and presentation of papers for such national meetings as the American Power Conference, ASME Winter Annual Meeting, ASME-AIEE Power Conference, ASEE Meeting, and panel discussions sponsored by TAPPI Steam and Power Committee. *PULP & PAPER* and *TAPPI* magazines have honored him by publishing reprints of various papers. He has willingly made local presentations at Georgia Tech Civil Engineering Student Section, ASME Sections in Birmingham, New Orleans, and Mobile, and ASME Student Sections at the University of Alabama and Mississippi State College.

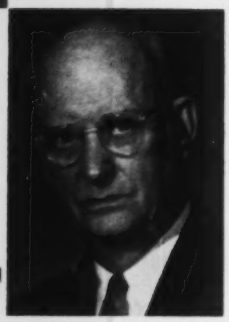
Mr. Judge is an honorary member of Pi Tau Sigma and is a member of The American Society of Military Engineers and The American Ordnance Association. He is a registered professional engineer in the State of Alabama.

E. W. Allardt



G. M. Muschamp

John Parmakian



R. C. Allen

## Nominated for Director

### Ernst W. Allardt

Ernst William Allardt, who has been nominated to serve a four-year term as a Director of The American Society of Mechanical Engineers, is chief engineer, Tubular Products Division plant of The Babcock & Wilcox Company, Alliance, Ohio.

A native of Ohio, he was born in Cleveland, Jan. 20, 1896, educated in the elementary and high schools of the city, and from 1918 to 1921 studied engineering at George Washington University. He also took several ICS courses in engineering.

He is considered a specialist in cold-roll metal-forming and electric weld tube and pipe mills. From 1922 to 1942 he was employed by The Yoder Company, Cleveland, Ohio, first as chief draftsman and later as chief engineer. During this period he was reponsibile for the design of several welded-tube mills 1 in. to 4 in. in capacity. He also designed a 26-in-diam pipe electric-resistance weld mill and accessory equipment at Youngstown Sheet and Tube Company. From 1936 to 1942 he designed many ERW tube mills and special sheet and strip metalworking machines.

In 1942 he joined The Babcock & Wilcox Company as chief engineer, Tubular Products Division plant, Alliance, Ohio, and has since designed several plants in the United States and Europe along with mills and accessory equipment.

Since joining the Society in 1926, Mr. Allardt has served ASME on the Executive Committee, Akron-Canton Section, 1946–1948, and as Section chairman 1948–1949; chairman of the Canton-Alliance-Massillon Section, which he helped to organize, 1950; and as chairman of the National Nominating Committee, 1954–1955. He was Vice-President of Region V, 1958–1959, and chairman of that Region's Member Gifts Campaign, United Engineering Center, 1959–1961, successfully achieving over 100 per cent of quota and receiving the ASME Certificate of Appreciation. He was a member of the International Council, ASME-EIC, 1958, and chairman in 1959. He also was a member of the ASME Presidential Advisory Committee on Unity and several other ad hoc committees, 1959, and is a member of the ASME Board on Membership.

In 1951 he received the ASME Achievement Award. In 1955 he was awarded the ASME 75th Anniversary Medal. That same year he became a Fellow and received the ASME Certificate of Merit.

Mr. Allardt has contributed extensively to the literature on operating electric-weld tube mills, including manuals and articles, and won the 1942 James F. Lincoln Arc Welding Foundation award. He holds American and British patents and is a registered mechanical engineer in Ohio.

### George M. Muschamp

George Morris Muschamp, patent engineer, has been nominated to serve for a four-year term as a Director of The American Society of Mechanical Engineers. An employee of Minneapolis-Honeywell Regulator Company, Philadelphia, Pa., he is vice-president in charge of engineering of the Industrial Products Group, Brown Instruments Division. He has been associated with Brown Instrument Company since 1930, becoming manager of engineering there in 1939 and vice-president in 1943. When the company became a division of

Minneapolis-Honeywell, Mr. Muschamp continued as vice-president in charge of engineering. Since 1957 he also has been staff director of research and product engineering for the company's other divisions, including the Davies, Heiland, Fall River, Rubicon, and Valve Divisions.

Mr. Muschamp was born in Philadelphia on Aug. 29, 1908, educated in Philadelphia public schools and the Drexel Institute of Technology, and took his first position with Fraley and Paul, patent attorneys, in 1927. He is a registered patent attorney and a registered professional engineer in Pennsylvania. He has served as a Philadephia delegate on the Engineering Manpower Commission.

A member of ASME since 1943, he was made a Fellow in 1957. He was chairman of the Philadelphia Section in 1952, chairman of the 1953 Constitution and By-Laws Committee, member of the 1953 Nominating Committee, chairman of the Organization Committee, 1955–1957, and member of the Society Growth Subcommittee of the Organization Committee, 1958. That same year, he also was chairman of the subcommittee of the Organization Committee on Revision of the Constitution and By-Laws. He has authored a number of technical papers and holds many patents and trademarks.

He is a member of the American Ordnance Association, Instrument Society of America, Engineers Club of Philadelphia, Philadephia Patent Law Association, the Recorder-Controlled Section of the Scientific Apparatus Makers of America, and the Engineering and Technical Societies Council of Philadelphia, the Newcomen Society in North America, and The Franklin Institute. He received the Drexel Institute Alumni Citation in 1951. Mr. Muschamp also was a scientific representative on the American Standards Association's Nuclear Standards Board.

## John Parmakian

JOHN PARMAKIAN, who has been nominated to serve a four-year term as a Director of The American Society of Mechanical Engineers, was born in Watertown, Mass., Sept. 9, 1908. He was graduated from the Masschusetts Institute of Technology in 1930 with a BS degree in mechanical engineering. He received his MS degree in civil engineering from the University of Colorado in 1939.

His professional career began in 1930 with the Bureau of Reclamation as a junior engineer in the testing of hydraulic structures and machinery at Hoover Dam. He currently is the Chief of the Technical Engineering Analysis Branch of the Bureau in Denver, Colo. In this position he directs, co-ordinates, and reviews the activities of a group of highly specialized engineers in the technical analysis of complex engineering problems pertaining to the design and construction of dams, hydroelectric power plants, and pumping plants.

Mr. Parmakian is the author of numerous technical articles published in various engineering and military journals in the fields of applied mathematics, antiaircraft gunnery, hydraulic transients, and vibrations in hydraulic machinery and structures. He is the author of a book, "Waterhammer Analysis."

During World War II he served in the U. S. Army in the Pacific Theater and in his final active assignment he served in the grade of Colonel as an Antiaircraft Group Commander on Iwo Jima. For the past 12 years he has served as the Commanding Officer of an Army Reserve Research and Development Unit in Colorado.

He joined ASME in 1949 and has served the Society in numerous capacities on the national, Regional, and Section levels. His major activity in the Professional Divisions has been in the Hydraulic Division. He was elected to the Executive Committee of that Division in 1955 and was its chairman in 1958–1959. He is currently the chairman of the Waterhammer Subcommittee and also a member of the Hydraulic Prime Movers and Cavitation Subcommittees of the Hydraulic Division. On the Section level he was elected to the Executive Committee of the Rocky Mountain Section in 1955 and was its chairman in 1957–1958. He served as chairman of the Technical Events Committee for the ASME Fall Meeting in 1956. On the Regional level he was a delegate to the Regional Administrative Committee from 1956 to 1958 and served as Regional Delegate at the Regional Delegates Conference in 1956 and 1957. He is currently the chairman of the Professional Activities Committee for Region VIII.

He has been on the ASME Speakers list for many years on the subject, "Waterhammer" and has made talks on this subject to various engineering groups and colleges.

In addition to membership in ASME, he is a fellow in the American Society of Civil Engineers and is also a registered professional engineer in the State of Colorado. He is also a member of Sigma Xi and Pi Tau Sigma.

## Robert C. Allen

ROBERT CHESTER ALLEN, who has been nominated to serve for two years as a Director of The American Society of Mechanical Engineers, is an inventor of power machinery, particularly in the aircraft jet propulsion field. Mr. Allen has been nominated to complete the unexpired term of W. H. Larkin who recently joined the ASME staff.

He has been associated with Allis-Chalmers Manufacturing Company, West Allis, Wis., since 1936, and was in charge of the company's early work in aircraft jet propulsion. He started in the steam-turbine department, where he was until 1947, and then became manager and chief engineer of the turbopower development department. He was consulting engineer of the General Machinery Division from 1951 to 1954 and director of mechanical engineering, Industries Group, from 1954 to 1960, when he became senior engineering consultant of that group.

Mr. Allen was born in Hartford, Conn., on July 16, 1889, and educated in the Hartford public schools, He began his career as a draftsman with the Terry Steam Turbine Company, Hartford, in 1910. From 1915 to 1931, he held several positions with Westinghouse Electric Corporation, at both E. Pittsburgh and Lester, Pa. He had charge of Westinghouse marine turbine developments for the World War I programs, and later was responsible for the development of new steam turbine designs. Before joining Allis-Chalmers, he also was chief engineer with A. O. Smith Corporation, Milwaukee, Wis., and the Murray Iron Works Company, Burlington, Iowa. Mr. Allen also directed many World War II projects for Allis-Chalmers. In 1941 he was appointed as an original member to the Special Committee on Jet Propulsion of the National Advisory Committee for Aeronautics (NACA), and in 1943 he went to England as a member of the U. S. Navy Mission to study British jet propulsion developments. During World War II he also directed the contract and engineering activities associated with building a 24-million-dollar supercharger production plant and manufacturing more than 100,000 turbo-superchargers for bombers and pursuit planes.

For the past ten years, he has been closely associated with the Allis-Chalmers nuclear power activities.

A member of ASME since 1941, Mr. Allen became a Fellow in 1959. He has served the Society as chairman of the ASME Research Executive Committee,

1954-1955, and as chairman of the Board on Technology, 1959, receiving the ASME Certificate of Award for his work on both committees. He also was chairman of the Technical Development Committee 1959–1961, and a former member of the Advisory Group of the ASME Nuclear Engineering Division. In 1956 he was appointed Honorary Vice-President to represent ASME at the VDI Centenary Celebration in West Berlin, Germany, on May 12–15 of that year. He was a member of the Engineering Foundation Board, United Engineering Trustees, Inc., from 1955 to 1959.

The holder of 68 patents as inventor or coinventor of steam turbines, gas turbines, aircraft jet propulsion engines, and other power machinery apparatus, Mr. Allen received a certificate in 1959 from the Milwaukee Patent Law Association in honor of his contributions to society through the medium of the U. S. patent system. In addition, the U. S. Navy awarded him a citation for technical services during World War II, and the University of Wisconsin recognized his professional services in the design of power equipment by presenting him with a citation in 1960. That same year he received an honorary DS degree from Marquette University.

The author of many technical papers, he also coauthored the chapter on "Power Generating Equipment" in the "Nuclear Engineering Handbook," 1958.

He has been a member of the Technical and Engineering Committee of The Atomic Power Development Associates, Inc. Detroit, Mich., since 1954.

He is a member of other professional societies including the Engineers Society of Milwaukee, The Society of Naval Architects and Marine Engineers, the Navy League of the United States, The American Society of Naval Engineers, The Wisconsin Society of Professional Engineers, NSPE, American Nuclear Society, and The Newcomen Society in North America, and is a fellow of the American Association for the Advancement of Science.

## Literature

(*Continued from page 105*)

series, "Techniques of Plant Maintenance and Engineering—1960," has been published.

It is a report of the Plant Maintenance and Engineering Conference, which was held in 1960 in Philadelphia, Pa. With 341 pages, it is largest of the series, and reports on the advance of automation from research and experiment to reality, as well as the significance of automation in maintenance operations. It includes 34 papers presented at the conference, and is available at $10, postpaid, from Clapp and Poliak, Inc., 341 Madison Avenue, New York 17, N. Y.

**Gas Dynamics.** "Dynamics of Conducting Gases," a compilation of the 18 invited papers given at the third biennial Gas Dynamics Symposium at Northwestern University in August, 1959, has been published in book form. The areas of plasma physics, plasma dynamics, and magnetogasdynamics are considered.

The 212-page volume is available for $12.50 a copy from the Northwestern University Press, Evanston, Ill.

**Mathematics.** The "Students' Mathematical Library," a new paperback series designed to present mathematics as a meaningful human activity to students and readers in general, will begin publication early in 1961. Many of America's leading mathematicians and scientists will contribute to the library, which will have its headquarters at New York University's Institute of Mathematical Sciences. Published jointly by Random House and Wesleyan University, the books will sell for less than a dollar each. The first to appear will be concerned with irrational numbers, infinity, mathematical logic, logarithms, and calculus. The library is an activity of the School Mathematics Study Group, a national association (with its headquarters at Yale University) whose goal is to improve the study of mathematics in American schools and to introduce students and laymen to generally untreated aspects of mathematics.

**Combustion Engines.** The International Congress of Combustion Engines (CIMAC) recently published the official report of its 1959 colloquium held in Weisbaden, Germany. Included are the general program, all speeches and lectures, texts of the technical papers presented, discussions, the list of participants, and general information on the committees and organization of CIMAC. The 1128-page book is available for DM 120 (postage and packing not included) from the Maschinenbau-Verlag G.m.b.H., Barckhausstrasse 16, Frankfurt/Main, Germany, or from the offices of the Deutsches Nationales Komitee, CIMAC at Brentanostrasse 29, Frankfurt/Main. Also available at the latter address are some of the individual papers in the original language of the authors.

# ASME 1962 National Nominating Committee Organizes

ELECTED at the 1961 Summer Annual Meeting of The American Society of Mechanical Engineers, Los Angeles, Calif., June 12, 1961, the 1962 National Nominating Committee at its organization meeting chose Frank L. Schwartz as chairman and H. H. Johnson as secretary.

The 1962 National Nominating Committee is composed of the following:

**Region I.** *Representative*, Frank Shires, assistant to chief engineer, Terry Steam Turbine Co., Terry Sq., Hartford 1, Conn.; *1st Alternate*, Henry M. Rogers, Jr., Charles Pfizer & Co., Inc., Eastern Point Road, Groton, Conn.; for mail, Box 331, R.F.D. 1, Whalehead Road, Gales Ferry, Conn.; *2nd Alternate*, Robert B. Parker, Morrison Warp Co. Div., Parker Machine Co., P.O. Box 196, 349 Barton St., Pawtucket, R. I.

**Region II.** *Representative*, H. H. Johnson, Consolidated Edison Co. of New York, Inc., Room 1506-S, 4 Irving Pl., New York 3, N. Y.; *1st Alternate*, Lawrence J. Schmerzler, staff consultant, Thermo Electric Div., General Instrument Corp., 65 Gouveneur St., Newark 4; for mail, 79 East McClellan Ave., Livingston, N. J.

**Region III.** *Representative*, John W. Sawyer, 4519—18th St., N. Arlington 7, Va.; *1st Alternate*, Lewis D. Conta, College of Engineering, University of Rochester, River Campus Station, Rochester 20, N. Y.

**Region IV.** *Representative*, T. C. Heyward, Jr., v-p, T. C. Heyward & Co., P.O. Box 3066, 518 East Morehead St., Charlotte 3, N. C.; *1st Alternate*, Kenneth T. Knight, associate, William C. Olsen and Associates, Box 271, Raleigh, N. C.; *2nd Alternate*, Arthur Croll, Atomic Energy Div., Savannah River Plant, E. I. du Pont de Nemours & Co., Inc.; for mail, 129 East St., S.W., Aiken, S. C.

**Region V.** *Representative*, J. Bruce Adams, sales representative, Blackwood-Hodge Equipment Ltd., 10 Suntract Road, Toronto 15, Ont., Can.; *1st Alternate*, Daniel Schild, assistant for re-

quirements, U. S. Air Force, Directorate of Engineering Standards, Wright Aero. Dev. Center, Wright-Patterson AFB; for mail, 3220 Cornell Dr., Dayton 6, Ohio; *2nd Alternate*, John R. Lowe, Jr., Reliance Elec. & Engrg. Co., 24701 Euclid Ave., Euclid; for mail, 32 Cabot Lane, Chagrin Falls, Ohio.

**Region VI.** *Representative*, George V. Miniberger, Harnischfeger Corp., 4400 W. National Ave., Milwaukee 14, Wis.; *1st Alternate*, Richard G. Henneman, Iowa-Illinois Gas & Electric Co., Davenport, Iowa; for mail, 3223—37th Ave., Rock Island, Ill.; *2nd Alternate*, S. P. Kezios, professor and director, Mech. Engrg. Dept., Heat Transfer Laboratory, Illinois Institute of Technology, Technology Center, 3300 S. Federal St., Chicago 16, Ill.

**Region VII.** *Representative*, Conway B. Briscoe, Water Commissioner, Water Div., City of St. Louis, Room 312, City Hall, St. Louis 3, Mo.; *1st Alternate*, James E. Rudolph, Minneapolis Div., Northern States Power Co., 15 South 5th St., Minneapolis 2; for mail, 2940 Orchard Ave., N., Minneapolis 22, Minn.; *2nd Alternate*, J. R. Buss, Res. & Engrg. Div., Monsanto Chemical Co., 800 North Lindberg, St. Louis 66, Mo.

**Region VIII.** *Representative*, Milton B. Thacker, Utah Oil Div., American Oil Co., P.O. Box 898, Salt Lake City 10, Utah; *1st Alternate*, Robert L. Sutherland, College of Engineering, University of Wyoming, Engineering Bldg., Laramie, Wyo.; *2nd Alternate*, Lee E. Wood, Atomic Power Div., Westinghouse Electric Corp.; for mail, 620 Lincoln Dr., Idaho Falls, Idaho.

**Region IX.** *Representative*, Russell D. Reese, Ted Nelson Co., Swan Island, Portland 17, Ore.; *1st Alternate*, Arthur K. Ingraham, Public Works Dept., U. S. Navy, U. S. Naval Station, Treasure Island, San Francisco 30; for mail, 5915 LaSalle Ave., Oakland 11, Calif.; *2nd Alternate*, H. A. Simms, Machinery Sales Div., Hawaiian Equipment Co., Ltd., Box 2990, Honolulu 2, Hawaii.

**Region X.** *Representative*, James M. Zilboorg, Pirineos No. 612, Lomas de Chapultepec, Mexico 10, D. F., Mex.; *1st Alternate*, Kenneth M. Wilson, A.M. Lockett & Co., Ltd., P.O. Box 5126, Beaumont, Texas; *2nd Alternate*, George J. Groh, vice-president, R. J. Tricon Co., Inc., 751 Tchoupitoulas St., New Orleans 12, La.; *3rd Alternate*, John H. Colby, Deer Park Plant, Diamond Alkali Co., P. O. Box 686, Pasadena; for mail, 8527 Brower, Houston 17, Texas.

**Region XI (new).** *Representative*, E. H. O'Neal, General Engineering Div., Florida Power and Light Co., P.O. Box 3100, Miami 30; for mail, 6770 S.W. 48th St., Miami 55, Fla.; *1st Alternate*, Thomas B. Kimball, Minute Maid Corp., Plymouth, Fla.; *2nd Alternate*, Robert E. Williams, Jr., Apparatus Div., Westinghouse Electric Corp., 1407 Commer Bldg., Birmingham 3; for mail, 6 Norman Dr., Birmingham 13, Ala.

**Technological Division.** *Representative*, John H. Hitchcock, Morgan Construction Co., 15 Belmont St., Worcester 5, Mass.; *1st Alternate*, Eugene W. Jacobson, Gulf R&D Co., P.O. Drawer 2038, Pittsburgh 30, Pa.; *2nd Alternate*, Martin Goland, president, Southwest Research Institute, Box 2296, San Antonio 6, Texas.

**Codes and Standards.** *Representative*, Philip Freneau, chief project engr., Southwestern Engineering Co., 4800 Santa Fe Ave., Los Angeles, Calif.; *1st Alternate*, James H. Harlow, Philadelphia Electric Co., 900 Sansom St., Philadelphia 5, Pa.; *2nd Alternate*, John P. Mooney, Engineering Div., Design Dept., Humble Oil & Refining Co.; for mail, 207 Burnett Drive, Baytown, Texas.

**Administrative.** *Representative*, Frank L. Schwartz, director of engineering, Lauson Power Products Div., Tecumseh Products Co., New Holstein, Wis.; *1st Alternate*, George F. Habach, v-p, Harrison Works, Worthington Corp., Harrison, N. J.; *2nd Alternate*, J. Keith Louden, exec. v-p, Lebanon Steel Foundry, 1st Ave. & Lehman St., Lebanon, Pa.

## ASME COMING EVENTS

**August 28–30, 1961**

ASME West Coast Conference of Applied Mechanics, University of Washington, Seattle, Wash.

**August 28–September 1, 1961**

Second International Heat Transfer Conference, University of Colorado, Boulder, Colo.

**September 14–15, 1961**

ASME-AIEE Engineering Management Conference, Hotel Roosevelt, New York, N. Y.

**September 24–27, 1961**

ASME-AIEE National Power Conference, St. Francis Hotel, San Francisco, Calif.

**September 24–27, 1961**

ASME Petroleum Mechanical Engineering Conference, Muehlebach Hotel, Kansas City, Mo.

**October 4–6, 1961**

ASME Process Industries Conference, Shamrock Hilton Hotel, Houston, Texas

**October 17–18, 1961**

ASME Bulk Solid Handling Symposium, Pick Nicollet Hotel, Minneapolis, Minn.

**October 17–19, 1961**

ASME-ASLE Lubrication Conference, Morrison Hotel, Chicago, Ill.

**November 26–December 1, 1961**

**ASME Winter Annual Meeting, Statler Hilton Hotel, New York, N. Y.**

**January 24–26, 1962**

ASME Second Symposium on Thermophysical Properties, Princeton University, Princeton, N. J.

**March 4–8, 1962**

ASME Gas Turbine-Process Industries Conference and Products Show, Shamrock Hilton Hotel, Houston, Texas

**April 5–6, 1962**

ASME-SAM Management Engineering Conference, Statler Hilton Hotel, New York, N. Y.

**April 9–13, 1962**

ASME Metals Engineering Division—AWS Conference, Sheraton Cleveland Hotel, Cleveland, Ohio

**April 10–11, 1962**

ASME-AIEE Railroad Conference, King Edward Hotel, Toronto, Canada

**April 30–May 3, 1962**

ASME Design Engineering Conference and Concurrent Show, Chicago Exposition Center, Chicago, Ill.

**May 7–8, 1962**

ASME Maintenance and Plant Engineering Conference, Royal Orleans Hotel, New Orleans, La.

**June 4–8, 1962**

Nuclear Congress (Biennial), New York Coliseum, New York, N.Y.

**June 5–7, 1962**

ASME Fuels Symposium, Rutgers University, New Brunswick, N. J.

**June 10–14, 1962**

**ASME Summer Annual Meeting, Chateau Frontenac, Quebec, Canada**

(*For Meetings of Other Societies, see page 100.*)

*Note:* Persons wishing to prepare a paper for presentation at ASME National meetings or Division conferences should secure a copy of Manual MS-4, "An ASME Paper," by writing to the ASME Order Department, 29 West 39th Street New York 18, N. Y. Price to nonmembers, 50 cents; to ASME members, free. Also available on request is a "Schedule of Program Planning Dates for Meetings and Publication Deadline Dates." Ask for Form M&P 1315.

# The 9th Annual Joint Engineering Management Conference to Be Held at Hotel Roosevelt, September 13–14, New York City

THE Joint Engineering Management Conference is sponsored by The American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Society of Civil Engineers, American Institute of Industrial Engineers with the co-operation of the American Institute of Chemical Engineers, American Institute of Mining, Metallurgical and Petroleum Engineers, The Institute of Radio Engineers, and the local sections of all the societies.

A feature of this year's conference is the presentation of the 1961 Henry Laurence Gantt Medal to Lyndall Fownes Urwick.

The conference is unique in that it is devoted entirely to the problems facing engineering managers. This is not a conference concerned with management techniques as they are applied to industrial production operations. It is a conference in which the focus is on the personal development, job environment, and professional goals of the engineer, and the function of the engineering manager in these areas.

This conference, sponsored by the professional engineering societies, is in its ninth year, and is held in a different part of the country each year. It is the outstanding conference devoted solely to the management of engineering activity, a subject becoming increasingly important as technology expands.

The Engineering Management Conference affords an opportunity for managers and for engineers to participate in discussions of a professional nature, in which the emphasis is on the improvement of the art and practice of the direction of technological effort in all fields.

**▶WEDNESDAY, SEPTEMBER 13**

**Early Bird Social** **4:00 p.m.**

**▶THURSDAY, SEPTEMBER 14**

**Session 1—Advanced Techniques and Engineering Management** **9:30 a.m.**

**PERT: A Technique for Management,**[1] by *K. M. Tebo*, General Motors Corp., Milwaukee, Wis.

**Statistics and Operations Research as Tools for Engineering Managers,**[1] by *C. F. Kossack*, IBM, Inc., White Plains, N. Y.

**Increased Profits Through Application of Computer Technology,** by *W. W. Eaton*, C-E-I-R, Alexandria, Va.

**Session 2—Expanding Interests of Engineering** **2:30 p.m.**

**Problems of Management in Foreign Countries,**[1] by *George Browne*, Editor, *Industria*, New York, N. Y.

**The Economic Environment in Which Engineers Work,**[1] by *Carl Madden*, Dean, College of Business Administration, Lehigh Univ.

**▶FRIDAY, SEPTEMBER 15**

**Session 3—Human Values in Management** **9:30 a.m.**

**Human Relations Problems in the Management of Engineering,**[1] by *E. H. Schell*, Professor-Emeritus, M.I.T.

**The Personal Approach in Dealing With Technical People,**[1] by *H. L. Cox*, Corn Products Corp., Chicago, Ill.

**Enhancing Human Values During Institutional Change,**[1] by *F. F. Bradshaw*, Croton-on-Hudson, N. Y.

**Session 4—Management of Research** **2:30 p.m.**

**Problems of Administration of Research and Development,**[1] by *H. C. Vernon*, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

**Management of Research and Development Personnel in an Industrial Laboratory,**[1] by *R. B. Mears*, United States Steel Corp., Pittsburgh, Pa.

[1] Paper not available—see box on this page.

# 1961 ASME Petroleum Mechanical Engineering Conference Program Results From Months of Planning and Hard Work

## Muehlebach Hotel, Kansas City, Mo., Headquarters from September 24 through 27

OIL industry engineers and executives from all over the world will gather for the sixteenth annual Petroleum Mechanical Engineering Conference to be held at the Muehlebach Hotel in Kansas City from September 24 to 27. An extremely important program for petroleum men has been developed by the ASME Petroleum Division after months of planning and hard work.

During twenty sessions technical papers in the fields of drilling and production, operating, manufacturing, materials, and refining-gas products-petrochemical, as well as panel discussion sessions will develop the answers to hundreds of questions that need answers in order to keep the United States petroleum industry in the position of world leader.

In addition, interesting social functions are planned to provide attendees the opportunity to renew old acquaintances and make new ones. Featured at the Welcoming Luncheon on Monday, September 25, which also will be attended by Members of the Engineers Club of Kansas City, guests will be welcomed officially to the city by the Mayor, The Hon. H. Roe Bartle. The response will be by Harold Grasse, Vice-President of ASME Region VIII, and the principal address will be made by William H. Byrne, President of ASME.

**▶MONDAY, SEPTEMBER 25**

**Session 1** **9:00 a.m.**
**Drilling and Production**

**Mechanical Refrigeration in Field Processing,**[1] by *J. L. Horton*, J. B. Beaird Company, Inc., Shreveport, La.

**Design of Engine-Jacket Water-Cooling Systems That Use Circulating Pumps,**[1] by *D. E. Marquis*, Phillips Petroleum Co., Bartlesville, Okla.

**Production Monitoring System,**[1] by *B. I. Dikman*, Black, Sivalls & Bryson, Inc., Kansas City, Mo.

**Session 2—Pressure-Vessel Design** **9:00 a.m.**
**Refining-Gas Products-Petrochemical**

**Strength of Thick-Walled Pressure Vessels for Materials With Directional Properties,** by *A. E.*

[1] Paper not available—see box on this page.

### ASME Papers by Mail

ONLY numbered ASME papers in the program are available in separate copy form until July 1, 1962. Prices are 50 cents to members of ASME, $1 to nonmembers, plus postage and handling charges. Payment may also be made by free coupons, or coupons which may be purchased from the Society in lots of ten at $4 to members; $8 to nonmembers. **You can save the postage and handling charges by including your check or money order and sending it along with your request to: ASME Order Department, 29 West 39th Street, New York 18, N. Y.** Papers must be ordered by the paper numbers listed in this program, otherwise the order will be returned. The final listing of available technical papers will be found in the issue of MECHANICAL ENGINEERING containing an account of the conference.

*Dapprich, Tu Lung Weng,* and *J. Marin,* Pennsylvania State Univ. (Paper No. 61—Pet-1)

**The Effects of External Pressure on Thin-Shell Pressure Vessel Heads,**[1] by *E. O. Jones, Jr.,* Auburn Univ.

**Strain Hardening in the Yielded Compound Cylinder,** by *S. J. Becker* and *H. Kraus,* Westinghouse Elec. Corp., Pittsburgh, Pa.

**Session 3—Cooling Tower Wood Deterioration** 9:00 a.m.
**Refining-Gas Products-Petrochemical**

**Preventing Decay of Wood in Cooling Towers,** by *R. H. Baechler, C. G. Duncan,* and *J. O. Blew,* U. S. Forest Products Lab, Madison, Wis. (Paper No. 61—Pet-5)

**Chemically Treating Cooling-Tower Lumber Protects Against Fungus Attack,**[1] by *J. R. Goff* and *J. S. Excell,* American Oil Co., Whiting, Ind.

**Session 4—Rubber Products and Elastomers Materials** 9:00 a.m.

**The Use of Elastomers in the Oil Field,**[1] by *R. G. Ruby,* Acushnet Process Co., Fort Worth, Texas

**Selecting and Specifying Rubber and Synthetic Materials for Petroleum Industry Use,**[1] by *R. C. Bascom,* B. F. Goodrich Chemical Co., Cleveland, Ohio

**Session 5—Drilling and Production** 2:30 p.m.

**Simulation of Sucker Rod Pumping Unit,**[1] by *W. E. Snyder,* Midwest Research, Kansas City, Mo.

**Analytic Study of Pipe Stresses in Slip Area,**[1] *D. W. Dareing* (sponsoring company), Jersey Production Research Co., Univ. of Illinois

**Session 6—Panel Discussion: Plant Maintenance** 2:00 p.m.
**Refining-Gas Products-Petrochemical**

*Panel Members: R. N. Price,* Columbia-Southern Chemical, Corpus Christi, Texas; *J. C. Klock,* Ethyl Corporation, Baton Rouge, La.; *O. S. York,* E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.; *R. B. Beattie,* Tidewater Oil Co., Wilmington, Del.; and *J. W. Tracht,* Penn-Salt Chemicals Corp., Philadelphia, Pa.

**Session 7—Power and the Pipeline Transportation** 2:00 p.m.

**Future Energy Sources for Pipelines,**[1] by *W. H. Decker,* Sinclair Research Labs, Harvey, Ill.

**Factors Involved in Rate Making for Pipeline-Energy Contracts,**[1] by *T. V. Grayson,* West Texas Utilities, Abilene, Texas

**Programing a Liquid Pipeline Operation for Optimum Power Conservation,**[1] by *Paul Pancio,* Gulf Refining Co., Houston, Texas

**Session 8—High-Energy Rate Forming** 2:00 p.m.
**Manufacturers**

**Working of Metals Via Explosives,** by *J. S. Rinehart,* Colorado School of Mines, Golden, Colorado. (Paper No. 61—Pet-3)

**Explosive Metal Forming Techniques,**[1] by *V. H. Montell,* Rocketdyne-No. Am. Aviation, Canoga Park, Calif.

## ▶TUESDAY, SEPTEMBER 26

**Session 9—Management Development and Industrial Engineering** 9:00 a.m.
**Refining-Gas Products-Petrochemical**

**Clearly Defined Ideals,**[1] by *T. B. Foster,* Emerson Consultants, Inc., New York, N. Y.

**Least-Cost Estimating and Scheduling (LESS),**[1] by *M. C. Frishberg,* IBM Corp., Los Angeles, Calif.

**Session 10—Gas Pipeline Transportation** 9:00 a.m.

**Automatic Station Control for Reciprocating Compressors,**[1] by *A. C. Winters,* Control Corp., Minneapolis, Minn.

**Study of Gas-Engine Performance Leads to Oil Development,**[1] by *E. W. Brennan* and *R. E. Moth,* The Pure Oil Co., Crystal Lake, Ill.

**The Development of a 5,500 BHP Engine—Compressor Unit With En-Block,**[1] by *J. J. Murphy,* Clark Brothers Co., Olean, N. Y.

[1] Paper not available—see box on page 120.

**Session 11—Automation Results** 9:00 a.m.
**Manufacturers**

**Factors in Automating Engineering Graphics,**[1] by *D. W. McArthur,* Minnesota Mining and Mfg., St. Paul, Minn.

**Numerical Control and Its Application to the Petroleum Industry,**[1] *Vance Rogers,* Boeing Applied Computing Services, Wichita, Kan.

**Session 12—Plastics Materials** 9:00 a.m.

**Mechanism of Failures of Plastic Pipes in Plant Usage,**[1] by *L. W. Gleekman,* Wyandotte Chemical Corp., Wyandotte, Mich.

**Epoxy Resin—As a Tool in Plant Maintenance,**[1] by *R. H. Bacon,* The Dow Chemical Co., Freeport, Texas

**Session 13—Drilling and Production** 2:30 p.m.

**Deformation of Drill Pipe Held in Rotary Slips,**[1] by *Thad Vreelands,* California Inst. of Tech., Pasadena, Calif.

**Teledeift Inclinometer,**[1] by *R. L. Alder,* Byron Jackson Co., Los Angeles, Calif.

**Special Equipment and Problems Associated With Large Diameter Drilling,**[1] by *James Allen,* Hugh B. Williams Mfg Co., Dallas, Texas

**Session 14—Panel Discussion: ASME Unfired Pressure Vessel Code** 2:00 p.m.
**Refining-Gas Products-Petrochemical**

*Panel Members: F. S. G. Williams,* Taylor Forge & Pipe Works, Chicago, Ill.; *G. E. Fratcher,* A. O. Smith Corp., Milwaukee, Wis.; *D. R. Loper,* Standard Oil Co. of California, San Francisco, Calif.; *R. F. Miller,* U. S. Steel Corp., Pittsburgh, Pa.; and *G. S. Chadwick, Jr.,* Union Carbide Chemicals, South Charleston, W. Va.

**Session 15—Accessory Equipment and LPG Pipeline Transportation** 2:00 p.m.

**Application of Optical Equipment for Installing and Checking Large Machinery,**[1] by *J. L. Hanold,* Kueffel and Esser Co., Hoboken, N. J.

**Use of Positive Displacement Meters to Develop Tank Tables,**[1] by *R. H. Pfrehm,* Humble Pipeline Co., Houston, Texas

**Modern Centralized Dispatching of Mid-American LPG Systems,**[1] by *W. F. Haley,* Westinghouse Air Brake Co., Houston, Texas, and *G. V. Rohleder,* Mid-American Pipeline Company, Tulsa, Okla.

## ▶WEDNESDAY, SEPTEMBER 27

**Session 16—Planning Utility Requirements for Refineries** 9:00 a.m.
**Refining-Gas Products-Petrochemical**

**Industrial Utilities Cycle Study Adapted to Linear Programing,** by *T. W. Stubblefield* and *G. C. McKeague,* American Oil Co., Whiting, Ind. (Paper No. 61—Pet-4)

**Planning and Forecasting Steam-Electric Requirements for a Large Refinery,**[1] by *W. B. Thomas* and *C. H. Griffenberg, Jr.,* Texaco, Inc., Port Arthur, Texas

**Session 17—Flow Control Manufacturers** 9:00 a.m.

**Automatic Control With the Plug Valve,**[1] by *J. A. Pommerschein,* Rockwell Mfg. Co., Norwalk, Ohio

**Automation in Orifice Fittings,** by *H. H. Hodgeman* and *T. J. Filban,* Daniel Orifice Fitting Co., Houston, Texas

**Session 18—Materials and Their Fabrication Materials** 9:00 a.m.

**The Refractory Metals and Their Alloys,**[1] by *Jack Chelius,* Fansteel Metallurgical Corp., North Chicago, Ill.

**Columbium Treated Mild Carbon Steels,**[1] by *C. L. Altenburger,* Great Lakes Steel Corp., Detroit, Mich.

**Welding Processes for Longitudinal Seam of Line Pipe,**[1] by *R. S. Ryan,* Columbia Gas System Service Corp., Columbus, Ohio

**Session 19—Piping and Pressure Vessel Design** 9:00 a.m.
**Refining-Gas Products-Petrochemical**

**Vessel Nozzles and Piping Flexibility,**[1] by *P. G. Stevens, V. J. Groth,* and *R. B. Bell,* American Oil Co., Whiting, Ind.

**The Design, Construction, and Operation of a Liquefied Petroleum Gas Storage System,**[1] by *W. T. Vann,* Chicago Bridge and Iron, Chicago, Ill.

**Session 20—Panel Discussion: ASA B31.3 Code for Refinery Piping** 2:00 p.m.
**Refining-Gas Products-Petrochemical**

*Panel Members: H. M. Howarth,* American Oil Co., Whiting, Ind.; *J. D. Lewis,* U. S. Pipe and Foundry, Burlington, N. J.; *D. R. Loper,* Standard Oil Co. of California, San Francisco, Calif.; *J. P. Mooney,* Humble Oil and Refining Co., Baytown, Texas; *D. W. Motter,* Esso Research and Engineering, Madison, N. J.; and *E. J. Vanderman,* The Lummus Company, New York, N. Y.

# San Francisco to Host 1961 ASME-AIEE National Power Conference

THE ASME-AIEE National Power Conference will be headquartered in the St. Francis Hotel opposite Union Square in the heart of downtown San Francisco, Calif., Sept. 24–27, 1961.

Early Bird registration will be held in the Olympic Room starting Sunday, Sept. 24, 1961, at 4:00 p.m. until 8:00 p.m. Arrangements have been made by the General Arrangements Committee, which is actively engaged in providing a balanced program, for inspection trips to the Pittsburg Power Plant of the Pacific Gas & Electric Company, the largest generating plant (1,330,000 kw) west of the Mississippi; the Geysers Power Plant of the Pacific Gas & Electric Company, the first and only geothermal power plant in the country; and the San Francisco Bay Area Salt Water Conversion Research Center, designed and operated by the University of California for the purpose of determining the costs and practicality of converting sea water into potable water. In addition to these scheduled inspection trips, other varied technical facilities are available on an informal basis in the Bay Area to power engineers and all conferees who are interested, such as the Sunnyvale Manufacturing Plant of the Westinghouse Electric Company, the Vallecitos experimental atomic power plant of the General Electric Company, and the Santa Clare, Pacific Power Division Plant of the Federal Pacific Electric Company.

On the social side, there will be a Welcoming Luncheon on Monday, Sept. 25, 1961, and a luncheon on Wednesday, Sept. 27, 1961. To mark the social high points of the conference, the reception and banquet will be held on Tuesday evening, September 26, the occasion of the address by the Hon. Fred

Seaton, former Secretary of the U. S. Department of the Interior.

Women's activities will be centered in the Hospitality Room each morning from 9:00 o'clock until noon, when coffee and rolls will be served. Hostesses will be present in the Hospitality Room on Monday and Tuesday afternoons from 2:30 p.m. to 4:30 p.m. Following a Gray Line Tour of San Francisco, the famed 49-mile drive, on Monday at 9:00 a.m., all the women are invited to 1:00 o'clock "Dutch Treat" "No Host" luncheon and fashion show at the St. Francis. Chinatown provides the venue for a tour on Tuesday, September 26, followed again by a "Dutch Treat" "No Host" luncheon of particular interest to those who delight in unusually choice preparation of Polynesian cuisine. Official activity for the women on Wednesday will depend on actual response and registration.

Some 24 technical papers will be presented at the conference. The program committees of both ASME and AIEE have been successful in obtaining outstanding authorities in the areas of nuclear plants, boilers, high-temperature steam, operating economics, automation, plant and performance testing, and turbine generators to present their papers in the seven technical sessions.

### Availability of ASME Papers

ONLY numbered ASME papers in this program are available in separate copy form until July 1, 1962. The final listing of available technical papers will be found in the issue of MECHANICAL ENGINEERING containing an account of the conference. Prices are 50 cents to members of ASME, $1 to nonmembers, plus postage and handling charges. Payment may also be made by free coupons which may be purchased from the Society in lots of ten at $4 to members; $8 to nonmembers. **You can save the postage and handling charges by including your check or money order made payable to ASME with your order and sending both to: ASME Order Department, 29 West 39th Street, New York 18, N. Y.** Papers must be ordered by the paper numbers listed in this program, otherwise the order will be returned.

### Availability of AIEE Papers

Copies of AIEE papers can be obtained by writing directly to the American Institute of Electrical Engineering, 33 West 39th Street, New York 18, N. Y. Prices are 50 cents to members and $1 to nonmembers. Papers must be ordered by the paper members listed in this program, otherwise the order will be returned.

## ▶MONDAY, SEPTEMBER 25

### Session 1—Nuclear Plants 9:00 a.m.

**Spectral Shift Control Reactor,**[1] by *James Coughlin*, The Babcock & Wilcox Co., Lynchburg, Va.

**Status of the High-Temperature Gas-Cooled Reactor,**[2] by *Titus LeClair*, General Dynamics Corp., San Diego, Calif.

**The ESADA Vallecitos Experimental Superheat Reactor,** by *John Barnard*, Gen. Elec. Co., San Jose, Calif. (AIEE Paper No. CP61-983)

**Hallum Nuclear Power Facility, Prototype for Advanced Sodium Cooled Power Station,** by *R. C. Gerber, C. L. Larson*, and *R. W. Dickinson*, Atomics International, Div. of North American Aviation, Canoga Park, Calif. (AIEE Paper No. CP61-988)

### Session 2—Boilers 2:00 p.m.

**Low Head Boilers for Industry,**[1] by *R. H. Wolin*, Combustion Engineering, Inc., Windsor, Conn.

**Operating Experience From a New Concept of Industrial Boiler Design,**[1] by *T. B. Hurst*, The Babcock & Wilcox Co., Barberton, Ohio, and *Jack Campbell*, Richfield Oil Co., Los Angeles, Calif.

**Inspection of Eddystone Station and Conclusions Regarding 1150 F Steam,**[1] by *J. H. Harlow*, Philadelphia Elec. Co., Philadelphia, Pa.

### Session 3—High-Temperature Steam 8:00 p.m.

**Metallurgical Evaluation of Superheater Tube Alloys After 12 and 18 Months' Exposure to Steam at 1200, 1350, and 1500 F,** by *C. L. Clark*, The Timken Roller Bearing Co., Canton, Ohio, *J. J. B. Rutherford*, The Babcock & Wilcox Co., Barberton, Ohio, *A. B. Wilder*, United States Steel Corp., Pittsburgh, Pa., and *M. A. Cordovi*, International Nickel Co., New York, N. Y. (ASME Paper No. 61—PWR-4)

**Scale Formation on Austenitic and Ferritic Materials Exposed to High-Temperature Steam,** by *F. Eberle* and *C. H. Anderson*, The Babcock & Wilcox Co., Alliance, Ohio. (ASME Paper No. 61—PWR-3)

**Evaluation of Weldments Joining Superheater Tube Alloys After Exposure to Steam at Temperatures of 1100–1500 F,**[1] by *W. E. Clautice*, U. S. Naval Engineering Experiment Station, Annapolis, Md.

**The Effect of Corrosion by Steam at 1100–1500 F Upon the Heat Transfer Through Superheater Tube Alloys,** by *H. L. Solberg, J. R. Brock*, and *W. J. Rebello*, Purdue Univ., Lafayette, Ind. (ASME Paper No. 61—PWR-1)

[1] ASME Paper not available—see box on this page.

[2] AIEE Paper not available—see box on this page.

### Session 4—Operating Economics 8:00 p.m.

**Transmission of Electric Energy Versus Transportation of Fuel,**[2] by *W. E. Hopkins*, Stone & Webster Engineering Corp., Boston, Mass.

**Auxiliary Drives and Factors Affecting Their Selection,** by *J. J. Heagerty*, Gen. Elec. Co., Schenectady, N. Y. (AIEE Paper No. CP61-989)

**Significance of Outage Records in Estimating System Growth Requirements,**[2] by *E. S. Loane*, Gen. Public Utilities Corp., Reading, Pa.

**Economic Scheduling of Generation by Valve Points,** by *A. P. Hayward*, Duquesne Light Co., Pittsburgh, Pa. (AIEE Paper No. CP61-986)

## ▶TUESDAY, SEPTEMBER 26

### Session 5—Automation 9:00 a.m.

**Philosophy of Boiler Automation,**[1] by *R. D. Hottenstine* and *R. W. Eggleston*, Combustion Engineering, Inc., Windsor, Conn.

**An Approach to Automation of Power Plants]Using the Concept of Parallel Programming,**[2] by *H. H. Gorrie*, Bailey Meter Co., Wickliffe, Ohio.

**Improved Measuring Techniques for Steam-Generator Heat Absorption,**[2] by *J. F. Cotter* and *F. C. Lisewick*, Combustion Engineering, Inc., Windsor, Conn.

### Session 6—Instrumentation for Plant Performance Testing 2:00 p.m.

**Instrumentation for Central Station Dynamic Response Tests,** by *D. Horwitz, R. D. Osborne*, Westinghouse Elec. Corp., Lester, Pa., and *H. G. Dallas*, Philadelphia Elec. Co., Philadelphia, Pa. (AIEE Paper No. CP61-984)

**Digital Computer Application for Accurate Steam-Turbine Performance Testing,** by *Ken Cotton, J. C. Westcott*, Gen. Elec. Co., Schenectady, N. Y., and *T. J. Glass*, Gen. Elec. Co., Phoenix, Ariz. (AIEE Paper No. CP61-985)

**Computer Processing of Heat-Rate Test Data,**[2] by *G. A. Manzatis* and *W. H. Barr*, Pacific Gas and Elec. Co., San Francisco, Calif.

## ▶WEDNESDAY, SEPTEMBER 27

### Session 7—Turbine Generators 9:00 a.m.

**Save That Turbine—A Starting Technique,** by *J. R. Hamann* and *D. C. Parker*, The Detroit Edison Co., Detroit, Mich. (ASME Paper No. 61—PWR-1)

**Transient Thermal Problems of Large Generators,** by *M. R. Lory* and *C. L. Wagner*, Westinghouse Elec. Corp., East Pittsburgh, Pa. (AIEE Paper No. CP61-987)

**Integrated Sea-Water Distillation and Steam-Power Generation Cycles,**[1] by *E. H. Miller*, Gen. Elec. Co., Schenectady, N. Y.

# Progress Report on ASME Research to Be Presented at National Power Conference

THE ASME Research Committee on High-Temperature Steam Generation will present a special progress report on its investigation into the effect of high-temperature steam on ferritic and austenitic materials at the National Power Conference at the St. Francis Hotel in San Francisco, Calif., on September 24. Four speakers will outline the results to date on this project on the effect on boiler tubes of up to 18 months of exposure to high-temperature steam at 1100 to 1500 F.

A paper scheduled for presentation by Dr. C. L. Clark of Timken Roller Bearing Company indicates that none of the tubes failed in tests at 1200 or 1350 F, although all but two failed at 1500 F. Dr. Clark indicates that the only mechanical properties that were appreciably influenced by exposure to high-temperature steam were elongation and impact strength. Most of this effect was experienced in the first six months of exposure with little further change after exposure as long as 18 months.

A second speaker, Prof. H. L. Solberg of Purdue University, describing the effect of corrosion on heat transfer through superheater tubes says that heat

transfer through ferritic tubes was reduced by as much as 15 per cent while dense scale on the austenitic alloys increased heat transfer over that of clean tubes by as much as eight per cent. He states that the increase is probably due to the increased roughness of the corroded surface.

In an evaluation of the weldments joining superheater tube alloys, also exposed to temperatures of 1100 F to 1500 F for periods up to 18 months, W. E. Clautice of the Naval Engineering Experiment Station concludes that weldments were found to be satisfactory. He noted a number of minor defects in the tubes and said that there was some indication of slow propagation of fissures over a period of time at the test temperatures.

A fourth paper by F. Eberle and C. Anderson, both of the Research Center, The Babcock & Wilcox Company, Alliance, Ohio, summarizes the results of their investigation into scale formed on 17 sample specimens of tubing. They conducted their examinations after six, 12, and 18 months' exposure to air and flowing steam of 2000-psi pressure at temperatures of 1100, 1200, 1350, and 1500 F. Their report is on the effect of temperature and length of exposure on a number of characteristics of the scale formed in the tube.

# Process Industries Division Sponsors First National Conference, October 4–6

HOUSTON, Texas, a city which is renowned for its commerce and culture, will be host to the first ASME Process Industries Conference, October 4–6, 1961. Headquarters for the conference will be the Shamrock Hilton Hotel where, commencing with the morning of Oct. 5, 1961, four technical sessions will include interesting papers dealing with compressors, sea-water conversion, pollution control, and water utilization. Houston is particularly well suited to be host for the conference, for inherent with its high concentration of petroleum and petrochemical industries, and its character of obtaining both municipal and industrial water supply from underground as well as surface sources, the problems of water pollution, utilization, and sea-water conversion are of great importance.

On the distaff side, the General Arrangements Committee has plans for an "Early Bird" social on Tuesday evening, Oct. 3, 1961, Welcoming Luncheon on Wednesday, Hawaiian Luau at poolside in the Shamrock Hilton on Wednesday evening, and a boat trip via the Houston Ship Channel to the San Jacinto Inn for a Captain's Dinner on Thursday evening. It is hoped that all conferees will take advantage of the inspection trip to Freeport, Texas, starting on Friday morning to inspect the facilities of the first municipal sea-water conversion plant in operation. Constructed by the Office of Saline Water, Department of the Interior, the plant was recently dedicated by Vice-President of the United States Lyndon B. Johnson and Secretary of the Interior, L. Hodges, and remotely activated by the President of the United States, John F. Kennedy.

### Availability of Papers

No PAPERS were available when this program went to press, therefore please *do not* order any paper listed in this program. The final listing of available technical papers will be found in the issue of MECHANICAL ENGINEERING containing an account of the conference. Prices are 50 cents to members of ASME, $1 to nonmembers, plus postage and handling charges. Payment may also be made by free coupons, or coupons which may be purchased from the Society in lots of ten at $4 to members; $8 to nonmembers. **You can save the postage and handling charges by including your check or money order made payable to ASME with your order and sending both to: ASME Order Department, 29 West 39th Street, New York 18, N. Y.** Papers must be ordered by the paper numbers, otherwise the order will be returned.

### ▶WEDNESDAY, OCTOBER 4

**Session 1** — **9:00 a.m.**

**Predicting Process Gas Performance of Centrifugal Compressors From Air Test Data,**[1] by *P. P. O'Neill*, E. I. du Pont de Nemours & Co., Inc., Beaumont, Texas, and *H. E. Wickli*, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

**Progress Toward Higher Speeds for Process Gas Centrifugal Compressors,**[1] by *W. A. Snow*, Elliott Co., Jeanette, Pa.

**Compressor Problem Associated With Metal-Chloride Vapor Mixtures,**[1] by *William Pechenick*, Catalytic Construction Co., Philadelphia, Pa.

**Session 2** — **2:00 p.m.**

**The First Municipal Sea-Water Plant in the United States,**[1] by *Allen Cywin, Gerald Dodd, R. H. Jebens*, and *H. D. Singleton*, Office of Saline Water, U. S. Department of the Interior, Washington, D. C.

**Operation of Butane-Freezing Pilot Plant for Saline-Water Conversion,**[1] by *George Karnofsky* Blaw Knox Co., Pittsburgh, Pa.

**Forced Circulation Vapor Compression Distillation for Desalination of Water,**[1] by *J. J. Williams*, Catalytic Construction Co., Philadelphia, Pa.

[1] Paper not available—see box on this page.

### ▶THURSDAY, OCTOBER 5

**Session 3** — **9:00 a.m.**

**How a Chemical Plant and a Community Have Worked Together to Solve a Waste Problem,**[1] by *George Schrader*, Union Carbide Chemicals Co., South Charleston, W. Va.

**Use of Sewage Effluent for Process Needs,**[1] by *C. H. Connell*, Univ. of Texas Medical School, Galveston, Texas

**Industrial Use of Diatometers to Measure River Health,**[1] by *Julian Coghill*, E. I. du Pont de Nemours & Co., Inc., Orange, Texas

**Session 4—Panel Discussion** — **9:30 p.m**

**Water-Pollution Problems on Gulf Coast**

*A. W. Bush*, Rice University, Houston, Texas
*T. H. Arnold*, McGraw-Hill Publishing Co., Houston, Texas

### ASME Fuels Symposium

THE campus at Rutgers University in New Brunswick, N. J., will accommodate an outstanding Fuels Symposium, June 5–7, 1962, to be sponsored by the ASME Fuels Division and the Mid-Jersey Section of ASME.

The theme of the conference will be "Fuels—Their Status Today." The entire program is to be organized by William T. Reid, Chairman of the Symposium and past-chairman of the ASME Fuels Division. Reid, a respected authority on fuels, is associated with Battelle Memorial Institute in Columbus, Ohio.

All conventional fuels plus the "exotic" types will come under discussion to review the past decade and consider: Reserves, market trends, export-import situation, transportation and storage, fuels for industrial purposes, fuels for space heating, fuels for power generation, fuels for transportation, synthetic fuels, space-age fuels, fuels for new energy conversion processes, and fuel research.

This outstanding program justifies the active interest of an exceptionally large number of people associated with utilization, research, transportation, production, and marketing of all fuels. The contributing authors will be recognized as the leaders in their fields.

This is a program for which advance planning for attendance and participation should begin immediately.

# 25th Annual Joint Solid Fuels Conference, Birmingham, Ala., Oct. 5–7, 1961

THIS year will mark the silver anniversary for the ASME-AIME Joint Solid Fuels Conference, which will be held at the Dinkler-Tutwiler Hotel, Birmingham, Ala., Oct. 5–7, 1961.

A diversified technical program has been planned, and topics ranging from computers in mining-system analysis, new methods in coal buying, import information on safety in burning pulverized coal, to the preparation of coal will be presented in four technical sessions.

A well-planned field trip is offered to the new 1,000,000-kw Southern Electric Generating Company's No. 1 Steam Plant in Wilsonville, Ala. Also, a complete program for the women is offered, which includes tours to the Southern Research Institute, Arlington Confederate Shrine, museums, and other places of interest.

### Availability of Papers

No PAPERS were available when this program went to press. The final listing of available technical papers will be found in the issue of MECHANICAL ENGINEERING containing an account of the Conference.

**▶THURSDAY, OCTOBER 5**

**Session 1** **9:00 a.m.**

**Preparation of Coal for the Metallurgical Market,**[1] by *J. L. McQuade*, Donegan Coal & Coke Co.

**Preparation of Coal for the Electric-Utility Market,**[1] by *J. E. Brown, Jr.*, Southern Elec. Generating Co.

[1] Paper not available—see box on this page.

**Coal Analysis at Western Electric Company, Hawthorne Station,**[1] by *M. M. Rayner*, Western Elec. Co.

**Session 2** **2:00 p.m.**

**Coal Handling for Industrial Steam Plants,**[1] by *W. C. Helt*, MCA.

**Installation of an Oscillating-Gate Spreader Stoker,**[1] by *R. P. Perkins*, E. I. du Pont de Nemours & Co., Inc.

**Bituminous Coal Reserves of the Southern Appalachian Coal Fields,**[1] by *R. Q. Shotts*, Univ. of Alabama

**▶FRIDAY, OCTOBER 6**

**Session 3** **9:00 a.m.**

**An Application of Computers to Mining Systems Analysis,**[1] by *R. W. Bouman* and *R. L. Frank*, Ohio State Univ.

**Conditions for Burning Pulverized Coal Safely,**[1] by *R. M. Hardgrove*, The Babcock & Wilcox Co., Alliance, Ohio

**Session 4** **2:30 p.m.**

**Electrofrac Techniques,**[1] by *Erich Sarapu*, *R. L. Calhoun*, and *John Clark*

**Production of Lightweight Aggregate From Washery Refuse,**[1] by *J. W. Meyers* and *others*, Bureau of Mines, Pittsburgh, Pa.

# ASME Elects Five to Grade of Fellow

THE AMERICAN Society of Mechanical Engineers has honored five of its members by electing them to the grade of Fellow of the Society.

To be qualified as a nominee to the grade of Fellow, one must be an engineer with acknowledged engineering attainment, have 25 years of active practice in the profession of engineering or teaching of engineering in a school of accepted standing, and be a Member of the Society for 13 years. Promotion to the grade of Fellow is made only on nomination by five Fellows or Members of the Society to the Council, to be approved by Council.

The men who were so honored for their outstanding contributions to their profession and to the Society are:

## Nelson D. Griswold

NELSON DOW GRISWOLD is general manager of the Engineering and Construction Services Division of The Dow Chemical Company, Houston, Texas. He is also a director of The Dow Chemical Company; the First State Bank, Clute, Texas; and Brazosport Savings and Loan Association, Freeport, Texas; and was a director of Dowell, Incorporated, and a director and vice-president of Brazos Oil and Gas prior to their merging with Dow. He presently serves on the division boards of Dowell and Brazos Oil and Gas. He is a pioneer in the use of chemicals for cleaning boiler tubes, and in the deionization of water for boiler feed.

He was first employed by The Dow Chemical Company in Midland, Mich., his birthplace, as a summer hire in 1919, and worked there several summers through 1923, when he received a BS in mechanical engineering from the Case School of Applied Science. A year later he earned his MS at Sheffield Scientific School, Yale University.

His direct experience in the power field began with summer employment in 1922 by Cleveland Electric Illuminating Company. At Dow Chemical in 1927, as assistant superintendent of power, he helped design plants totaling 35,000 kw and generating more than one million pounds of steam per hour. As a mechanical engineer in 1931, after completing the power-plant design, he supervised the construction and initial operation of the boilers and generating unit. He progressed to the post of chief engineer for Cliffs Dow Chemical Company at Marquette, Mich., and later, as chief engineer for Dowell, Incorporated, Midland, designed and followed the manufacture of equipment in use today throughout the field of oil-well cementing and industrial acidizing.

He designed and developed a pump that became the heart of Dowell's business.

He went to Freeport in 1941 to do special engineering for the Texas Division of Dow, which was developing two plants to manufacture magnesium from sea water. There he became assistant general manager in 1942 with responsibility for the engineering, power, and gas and water departments. He pioneered the industrial use of water from the lower Brazos River, and was in charge of the design and installation of the two largest industrial reservoirs on the Brazos, developing enormous water reserves for the Texas Division. He had an important role in the development and organization of Brazos Oil and Gas. He also had charge of rapidly expanding the Texas Division power facilities including the adapting of World War I Hellgate and Conners Creek power equipment for World War II magnesium production.

A principal figure in the founding of the Texas Water Conservation Association, Mr. Griswold also served as city commissioner of Freeport, and helped develop the city's drainage system, levees, and storm-water pumping plant.

At home, Mr. Griswold operates a complete machine shop, constantly working to develop new concepts for mobile pumps and mechanical devices. He has authored a number of papers on water resources, and holds several patents.

A member of ASME since 1924, he also is a member of AIEE, AIME, AAS, TSPE, Texas Academy of Science, Armed Forces Chemical Association, Atomic Industrial Forum, Texas Dow Institute, Houston Club, Riverside Country Club, Brazosport Chamber of Commerce, Texas Water Conservation Association, American Museum of Contemporary Art, Tau Beta Pi, Sigma Psi, Theta Tau, and Phi Kappa Tau. He is a director of the Houston Engineering and Scientific Society and of the Foundation for Cycle Research. He was the first chairman of the Brazoria County United Fund, and is presently a director.

Mr. Griswold is a registered professional engineer in Texas.

## W. E. Hopkins

William Edgar Hopkins, consulting engineer at Stone & Webster Engineering Corporation, Boston, Mass., has contributed extensively to the advancement of power-engineering technology and central-station design during his years of active practice with manufacturers and engineering companies. He has helped establish as working projects important technological advancements, particularly concerning modern reheat installations, and the cyclone furnace method of burning low ash fusion temperature coal. He has contributed to major advances in the design of long-distance conveyer systems, industrial steam and power facilities, and waste-disposal systems. He has provided leadership for the successful prosecution of major engineering projects involving the economic selection, coordination, and use of available technology, equipment, and engineering talent.

The recipient of a BE degree in mechanical engineering from Johns Hopkins University in 1924, he broadened his early knowledge through courses in industrial engineering and business administration at Marquette University, Columbia University, and New York University and through experience with manufacturing, operating, and engineering companies. Throughout his career, Mr. Hopkins has gathered specialized knowledge in management, in steam, hydroelectric and nuclear power, in plant design and layout, and in machinery for manufacturing cement and crushed stone.

During the last 24 years, he has solved industrial problems for an extensive list of manufacturers, including power companies, food and fruit companies, and paper manufacturers. He has supervised the installation of new boiler and power equipment as well as the improvement of existing equipment for manufacturers throughout the United States and in several other countries, including Canada and Jamaica. He has made reports for projects in Iran and the Dominican Republic. He helped install the first cyclone-fired boiler, at Stone & Webster, and the first coal-fired boiler in the State of Florida. During World War II, he assisted in the improvement of naval installations and the conversion of many boilers from oil to pulverized coal firing. One of his most unusual projects is contained in a report he prepared on a proposed permanent installation of an overland belt-conveyer system to extend over 100 miles from Lake Erie to a southern terminal on the Ohio River. He was responsible for the feasibility of the design of the system with twin belts, one to carry iron ore south, the other to carry coal north, and developed later modifications of this design. He also applied his consulting services to a proposed project for a passenger belt conveyer system between Grand Central Terminal and Times Square in New York City. As a materials engineer with the Civil Works Administration, 1934–1936, he selected mechanical equipment for the five boroughs of New York, set up record systems, and supervised the requisitioning, accounting, receiving, storing, and dispersing of equipment for work projects. The International Bank for Reconstruction and Development in 1958 called for his services regarding the proposed Dez River hydroproject in Iran for supplying electric power in the Khuzestan region.

He became a senior mechanical engineer for Stone & Webster Engineering Corporation in 1959, and consulting engineer in 1960. He has authored a number of articles on the design and modernization of power plants that have appeared in several engineering magazines, including Mechanical Engineering. A member of ASME since 1935, he has devoted his time to the Power Division, where he was a member of the Executive Committee, 1953–1959, chairman in 1958, and chairman of their Honors Committee in 1960. At present, he is a member of the ASME Medals Committee. He served the New York Metropolitan Section as a member of the Junior Committee, 1934–1935; and the Boston Section, as chairman of the Membership Development Committee and a member of other committees in that section.

He holds membership in the Massachusetts Society of Professional Engineers, having been chairman of the metropolitan chapter, 1947–1948; in NSPE, and in the International Electrotechnical Commission. He is a registered professional engineer in New York, Pennsylvania, Illinois, Connecticut, Florida, and Massachusetts.

In 1946 he organized the Dynamion Society to advance engineering thought and knowledge within the Stone & Webster organization. His civic activities include being alderman and past-chairman of the planning board for the city of Newton, and director and chairman of youth work for the Newton YMCA.

## J. J. King

Joe Judson King is President of Tenneco Chemical Company of Houston, Texas. Tenneco Chemical is a subsidiary of Tennessee Gas Transmission Company, and under it falls all of the chemical and petrochemical activities of the parent company. These areas include Petro-Tex Chemical Corporation, owned 50 per cent by Tenneco and 50 per cent by Food Machinery and Chemical Corporation; and the petrochemical complex presently being constructed on the Houston Ship Channel by Tenneco Chemical. Both companies are multi-million-dollar concerns.

King pioneered in electric-driven and combustion gas-turbine driven high-pressure centrifugal compressors for modern natural-gas transmission pipelines. He engineered the first of these installations in the United States in 1947 and 1948. Both were used by Tennessee Gas Transmission Company on its natural-gas transmission system.

He was on military leave of absence from the then "The Texas Company" for two and one-half years during World War II and served as chief of the pipeline section and Executive Officer, War Plans Division, Office of the Chief of Engineers, Washington, D. C. His responsibilities included the design of military pipelines and bulk liquid fuel-handling facilities, training of pipeline and terminal personnel, logistical planning for pipelines in theaters of operation, supervision of the Army supply program for military pipeline material, and other areas involving the use of pipelines for movement of aviation and motor gasoline and diesel fuel during World War II.

He joined Tennessee Gas Transmission Company in 1946 as compressor-station superintendent. From that position he served as chief engineer, vice-president, and senior vice-president until December, 1960, when he was elected president of Tenneco Chemical Company.

He became an associate member of the ASME in 1928, a member in 1937, and

he is past-chairman of the South Texas Section of the ASME. He has been a registered professional engineer in Texas since 1938. He was one of the first members of the ASME Sectional Committee No. 8 formed to develop the Code, ASA B31.8, "Gas Transmission and Distribution Piping Systems."

He is on the boards of directors and the executive committees of Petro-Tex Chemical Corporation, Grand Central Rocket Company, and Cary Chemicals, Inc. He is a member of the board of trustees and the development board of Southwest Research Institute, San Antonio, Texas; and a member of the Advisory Council of the Engineering Foundation of the University of Texas. He is also past-chairman of the Advisory Council.

He became a member in 1932 of the Houston Engineer's Club (now Houston Engineering and Scientific Society) and was instrumental in developing the Society to its present stature.

He was one of the early members of the Petroleum Club of Houston and is a member of Lakeside Country Club of Houston.

King is a graduate in mechanical engineering of the College of Engineering of the University of Texas and a graduate of the South Texas School of Law in Houston.

## A. W. Rathe

ALEX W. RATHE is associate professor of management engineering at New York University. A specialist in management, he has contributed to the organization of the nation's production and resources management both in peacetime and in wartime.

He handled his first production control assignments in Budapest, Hungary, and in London, England, 1935 to 1937, while working with the Hungarian Laboratories. He did liaison work, made motion and time studies, personnel and organizational surveys while earning industrial and electrical engineering degrees at the Charlottenburg Institute of Technology, Berlin, Germany. After that, he took special studies at M.I.T. and Harvard University, meanwhile gaining practical experience with Display Lighting Corporation in Jamestown, N. Y., and New York City. He helped introduce the organization's first work-simplification programs which increased its work volume in the manufacture of mechanical equipment by 450 per cent while the work force expanded less than 20 per cent.

With the onslaught of World War II, he moved into defense work with Jackson and Moreland, Boston, Mass. In 1943, he instituted management controls in the Corona Corporation, Jersey City, N. J. where he was chief industrial engineer. At the General Instrument Corporation, Elizabeth, N. J., as chief production engineer, and at the Hudson American Corporation, New York, N. Y., as chief industrial engineer and assistant to the executive vice-president, he was concerned with planning, organization, and control problems as well as with the direction of production and other major functional areas.

Thereafter he built his own consulting engineering practice in management. His professional assignments comprise primarily top-management problems. Dr. Rathe has also served the U. S. Departments of State and of Defense as well as the Organization for European Economic Co-operation (NATO). Since 1949, he has also been associate professor at New York University, teaching graduate courses in industrial engineering and management.

A member of ASME since 1943, he has been Chairman of the Industrial Conservation Committee, 1951; Chairman of the Honors Committee, Management Division, from 1952 to 1955; and ASME representative on the Gantt Medal Board of Award since 1956.

He has been a member of the board of directors of EJC from 1956 to 1960 and is serving ECPD as a curriculum inspector. A charter member of AIIE, he was president from 1960 to 1961. He is a member of ASEE and NSPE, a fellow of AMA and SAM as well as an honorary faculty member of the U. S. Army Logistics Management Center. and an honorary member of Alpha Pi Mu.

He has been awarded the Certificate of Outstanding Achievement of AIIE and the Distinguished Service Certificate of the U. S. Army Command Management School. The author of a large number of booklets and papers, one of which appeared in MECHANICAL ENGINEERING in 1952, he wrote "How to Set up Management Controls" in 1948. Three years later, he coauthored the booklet "Cybernetics and Society" with Norbert Wiener and Luther Gulick.

AMA published, in 1953 and 1954, his writings on "Planning and Review" and on "Top Management Planning and Control." Dr. Rathe also contributed a chapter to "Management Control Systems," published by John Wiley & Sons in 1960, and to the "Fifty Years' Progress Report in Management," issued by ASME in the same year. He edited Henry Laurence Gantt's writings for their republication this year in honor of the one-hundredth anniversary of the author's birth in 1861. He is a registered professional engineer in New Jersey and New York.

## F. P. Tisch

FRANK P. TISCH of the Voi-Shan Manufacturing Company, division of Voi-Shan Industries, Inc., Culver City, California, is well known for his work on the unification of engineering standards in screw threads and threaded products. He is an internationally recognized authority on threaded fasteners and allied components. He signed the Declaration of Accord, for the Unification of Screw Threads, on Nov. 18, 1948, as the representative of ASA-ASME-SAE. He has taken a leading part in the American-British-Canadian Conferences on the unification of engineering standards and has done distinguished work with the Industrial Fasteners Institute, the Screw Service Bureaus, and as a liaison member of the Interdepartmental Screw Thread Committee.

Mr. Tisch was with the Pheoll Manufacturing Company, Chicago, Ill., for 28 years, engaged as an engineer and chief engineer, in establishing new shop-manufacturing standards and methods, the design of new equipment, and the control of gages. During this time he became active in the standardization of threads and bolts, screws and nuts, and served as chairman of the Screw Industry Standards Committee for eight years and a member of the technical committee of the American Institute of Nut, Bolt and Rivet Manufacturers for 15 years. Since 1956 he has been materials and processes engineer with the Voi-Shan Manufacturing Company, specializing in precision fasteners and related products made from alloy steel, superalloys, and refractory alloys for the aerospace missile industry.

A member of ASME since 1942, he has served on the Society's Board of Codes and Standards and on the Standardization Committee of which he was chairman in 1957. He has served ASA as a member of the Standards Council, the Board of Codes and Standards, and Sectional Committees B1, B18, B27, and Y14. He has the ASA certificate of service for his work in developing American Standards, and has been chairman of ASA Sectional Commitee B1, Standardization and Unification of Screw Threads, since 1951. He also served as a representative of the U. S. Machine, Cap, Tapping and Wood Screw Bureaus on Sectional Committee B18, Dimensional Standardization of Bolts, Nuts, Rivets, Screws, and similar fasteners.

Conducted for the National Junior Committee

STEWART H. ROSS

# JUNIOR FORUM

*Junior Forum gets a new editor once a year. This is just as it should be—and for two excellent reasons. Your last editor has been punctually meeting deadlines for 12 months; by now, he should be pleased to turn over the voluntary responsibilities to another. And second, tradition has it that a new editor "from the ranks" will be in closer touch with the readers.*

*This column functions as the sounding-board of the National Junior Committee which represents the young associate membership of ASME. Without comment from you, the readers, we can only guess that we are serving your needs.*

*We hope to discuss subjects of interest to you. The mean age of the engineer in this country has been dropping steadily; it now stands at 32. Your society recognizes your importance and also is concerned about what you consider your needs, interests, goals.*

*We plan to talk about the nonengineering skills necessary to make you a better engineer—and we will get basic. We will talk about reading (speed reading) and writing (technical writing).*

*We are going to introduce you to the frontiers of such burgeoning new and diverse space-age technologies as cryogenics and high-temperature metallurgy.*

*We will tell you about engineer-manager relations and will call on results of surveys to illustrate the attitudes of your fellow engineers. And then we will present what we hope will be convincing arguments on the needs of the profession for the contributions of younger engineers In this area, we will cover the broad subject of engineering professionalism. Here, we will try to be original and not merely preach to you on the virtues of registration and participation in community affairs.*

*We also will give you some pointers on preparation of résumés and how to act at an interview, for skills such as these are important items in every young engineer's portfolio.*

*We hope you will turn to Junior Forum regularly—and then give us the feedback so necessary for this column to mirror accurately the ideas of a vital segment of ASME membership.*

## Personality Traits. . .

### "... sensitizing the younger men to the opinions which their future employers entertain about matters of personality."

Thirteen years ago a study was completed under the aegis of Engineers' Council for Professional Development. The thorough study dealt with personality traits of engineers.

Although studies as old as this, as a general rule, scarcely merit attention in our fast-accelerating technological environment, we don't think that the undesirable "character" of 1948 would be less undesirable today. Needless to say, the study should be repeated soon to at least up-date the results. We also think that it may be possible to increase the study's objectivity.

The results of the study served then, in the words of the ECPD special subcommittee, "the purpose of sensitizing the younger men to the opinions which their future employers entertain about matters of personality." Let's look at the study and its findings.

First, six broad areas of personality characteristics were selected for the test: Organizationally acceptable, emotionally acceptable, physically acceptable, dynamic, dependable, and intelligent. Although these six characteristics could be considered arbitrary, they were carefully defined and categorized.

Organizationally Acceptable—self-possessed, dignified, thoughtful, likeable, considerate, co-operative.

Emotionally Acceptable—responsive, pleasant, frank, animated, stable, courageous.

Physically Acceptable—masculine (or feminine), good carriage, well-groomed, clean, smiling, ability to talk in public.

Dynamic—active, effective, punctual, perseverant, desirous of added responsibility, confident.

Dependable—truthful, high-principled, reliable, promising, magnanimous, factual.

Intelligent—clear thinking, reasonable, careful, imaginative, shrewd, adaptable.

**Study Subjective.** To avoid too broad a subjective interpretation by the respondents of many of these obviously vague terms, definitions were referenced to a standard source (a particular paragraph, in a particular edition of *Roget's Thesaurus*). It should be understood, however, that the "scientific approach" is not possible when dealing with such intangible qualities as thoughtful, stable, confident, or reasonable.

The questionnaire first was distributed among a group of executives experienced in the hiring and direction of young engineers. These individuals indicated a distinct order of preference for Intelligent for first place (as representing the most important personality trait) and Physically Acceptable for last. Of the respondents, 80 per cent selected Intelligent as their first or second choice; only 18 per cent listed it as third or fourth most important. Physically Acceptable was selected by more than 90 per cent of these executives for fifth or sixth place.

**Functional Subdivisions.** Four functional divisions of engineering in addition to the General Classification also appeared on the questionnaire—Research and Invention, Design and Construction, Production and Management, and Sales and Distribution. Additional rankings were requested of the respondents if a conviction existed that a different order of choice might be desirable in considering qualifications of prospective employees for any of these specific engineering areas. Of this first group of respondents, 65 per cent thought there should be differences.

These results furnished interesting similarities and contrasts. The pattern for Research—Invention and Design—Construction parallels that of the General Classification, with Intelligent and Physically Acceptable again at the extremes.

In Production and Management, however, while the order remained about the same, Intelligent held first place by only a

[1] Proposals writer, Product Information Operation, General Electric Company, Pittsfield, Mass. Assoc. Mem. ASME.

slight margin. And, as might be intuitively anticipated, results for Sales and Distribution were completely different. Dynamic and Physically Acceptable moved to first and second place, respectively. Intelligent fell to fourth.

Broad conclusions drawn from the findings are that intelligence and dependability are qualities most required in research and design work. For here two factors are of importance—the individual and the problem.

In the fields of Production and Management and particularly in Sales and Distribution, three somewhat dependent factors play a role—the personality of the salesman, the characteristics of the buyer, and the product. There can be no general, across-the-board sales type of individual, for the results indicate that it would be difficult to hire a person who could successfully sell anything to anybody.

The survey was then widened by tapping the opinions of two other groups: College administrators and engineering-school faculties. Although the administrators tended to give equal weight to Intelligent and Dependable factors and to regard Emotionally Acceptable as more important than Dynamic, in contrast to the executives and the faculties, over-all results exhibited surprising similarity.

A further extension of the study, aimed at including the opinions of nonengineering people, was made to determine if consistency still would be maintained. A representative cross section of businessmen and general personnel officers who were polled (only in the General area), however, yielded results substantially the same as for the three earlier groups, except in the qualities of Dynamic and Emotionally Acceptable. The personnel people distinctly reversed the relative positions previously established for these characteristics, placing Dynamic in fifth place, just above Physically Acceptable, and advancing Emotionally Acceptable to fourth.

**"Meanwhile, Back At The Campus..."** As is so common in studies of this type, the researchers sought out the opinions of the "younger men" back at the campus. An entering freshman class and a senior class were similarly polled. Results here pointed to no great shift from the conclusions already obtained. However—and this possibly can be a comfort for industry committed to a policy of management recruitment from among its engineers—the campus contribution most closely paralleled the findings from the executive group!

The over-all results obtained from the survey must be viewed simply as a good attempt at measuring what is extremely difficult to measure.

Of greatest importance was the uncovering of fundamental differences between the desired personality attributes of research-design engineers on one hand, and production-sales engineers on the other. As in any such study, the pollsters are ready to accept as valid the results of their project (as well as the validity of the procedures themselves) when results reinforce their original contentions.

How should the young engineer himself assess the results?

Obviously, a wide-awake company recruiter—assumed to weigh the six personality factors according to the results of this study—will be trying to probe all the qualities of the prospective employee across the desk from him. But in one hour, or even a half-day, can he do more than evaluate the least important trait of all, Physically Acceptable?

So it is obvious that the engineer must, at the minimum, be acceptable physically (neatly dressed and clean-shaven).

Beyond this, a few more conclusions can be drawn.

The engineer must realize that he is judged by his superiors and his peers as whole man. Although his mental prowess will be the ingredient generally most sought after, he cannot hide his other traits. The engineer must be aware that his contribution to his company and the subsequent rewards for his performance will be measured by reference to a number of totally independent yardsticks.

## Call for Agenda Items for 1962 RAC Meetings

THE 1962 Agenda Committee extends an invitation to every member of ASME to offer suggestions and improvements in the operations of the Society. This invitation is a step in the democratic process by which the membership and the Sections impart their ideas to the Council.

Please word your proposed items so that they are clear and specific and so that there will be no misunderstanding as to intent. Also, be sure the wording is positive so that action can be taken either to "accept" or "reject" the item as worded. Accompany each item with a short statement as to why you feel the item should be approved.

All agenda items are to be submitted in accordance with the following form, *and should be sent to the Secretary of your Section not later than Oct. 1, 1961.*

The Agenda Committee of each Section will screen these items against items previously considered by the Council, and forward the items to the National Agenda Committee not later than Nov. 1, 1961.

If you lack the address of your Section Secretary, you may send your items, *not later than October 1, to the ASME Agenda Committee, 29 West 39th Street, New York 18, N. Y.*

**ASME Agenda Item**

Proposed by ..... of the ..... Section

Address .....

Date .....

Signature

Item: It is proposed that .....

Proposer's Comment:

## NJC in the Berkshires

TO CONDUCT some unfinished business the National Junior Committee met last month at the Jug End Barn, South Egremont, Mass. Crowded agendas of the two past Headquarters' meetings had cut short vital discussion periods.

Committee members, and wives, who attended the combined business-pleasure weekend (July 15 and 16) included NJC Chairman Norman Viehmann, Secretary Paul R. Beswick, Stewart H. Ross, William W. Vogelhuber, A. S. Goldstein, and Bernard Meany.

Items discussed at length were:

1 Importance of Section-level implementation of young-engineer participation in civic affairs programs.

2 Means of culling reader interest and participation in Junior Forum.

3 A recommended program to ASME's Professional Divisions for participation by young engineers in PD meetings.

4 Reports to NJC from the Junior Representatives present.

# ENGINEERING SOCIETIES PERSONNEL SERVICE, INC
[Agency]

THESE items are listings of the Engineering Societies Personnel Service, Inc. This Service, which co-operates with the national societies of Civil, Electrical, Mechanical, and Mining, Metallurgical and Petroleum Engineers, is available to all engineers, members or nonmembers, and is run on a nonprofit basis.

If you are interested in any of these listings, and are not registered, you may apply by letter or résumé and mail to the office nearest your place of residence, with the understanding that should you secure a position as a result of these listings you will pay the regular employment fee. Upon receipt of your application a copy of our placement-fee agreement, which you agree to sign and return immediately, will be mailed to you by our office. In sending applications be sure to list the key and job number.

When making application for a position include eight cents in stamps for forwarding application.

NEW YORK
8 West 40 St.

CHICAGO
29 East Madison St.

SAN FRANCISCO
57 Post St.

## Men Available[1]

### Chicago Office

**Senior Engineer or Project Manager,** BSME; BS general engineering; 42; registered engineer; 15 years' diversified design and supervisory experience steam-power plant. Proved ability in equipment design and selection and plant layout. Coordination of related structural, architectural, mechanical, and electric design. Client contact. $12,000–$15,000. West or Midwest. Me-2226-Chicago.

**Supervisor of Design, Construction and Maintenance of Plant,** or institutional buildings and equipment; Cornell Univ., CE, 1930; 51; 20 years with producer of steel castings, fabricated RR equipment products, and heavy machine tools. In full responsible charge of design, construction, and major maintenance of production equipment and buildings in multiplant operation. $12,000. Midwest. Me-2225-Chicago.

**Engineering Sales,** BSME; 40; three years service supervisor and two years territory manager for manufacturer of agricultural and industrial equipment; eight years owner of retail car, truck, and equipment business. Salary open. Location immaterial. Me-2224-Chicago.

**Design and Development, Sales, Testing-Management Training,** BSME, MBA; 29; project engineer for design, development, and supervision of delivery of ordnance devices for aircraft and missile industry (including seven units used on Project Mercury). Also design of lab equipment and supervision of machine shop. $7500. Location immaterial. Me-2223-Chicago.

### New York Office

**Mechanical Design Engineer,** graduate ME; 61; experienced in material handling, belt conveyers, HP piping, machinery design. $10,000 minimum. Metropolitan N. Y. or N. J. Me-969.

**Professor of Mechanical Engineering,** MS(ME), 1949; eight years' experience teaching mechanical design; five years' experience in system and equipment analysis for nuclear power industry. Registered engineer in Pa. and Wis. $10,000. Midwest. Me-970.

**Project Engineer, Mechanical,** BME, MS; ten years' experience, three of which were spent on packaging of military communication equipment, plus seven years of R&D in pneumatic instruments and thermodynamics. Desires R&D position. $10,000. East Coast, South. Me-971.

**Executive Engineer,** BA, PE; 21 years' experience large manufacturing, engineering, and construction projects at corporate level. Direct and administer interplant production policies, capital appropriations, and technical operations. Proved ability to handle top-level decisions. Latest experience nonferrous metal field. $14,000. N. Y. Me-972.

**Sales Engineer,** BSME, PE; 12 years' broad experience in manufacturing. Good knowledge and understanding of problems in industry, the orientation and motivation of its key men. Perception of an engineer, dedication of a manager. Able to resolve facts, cut through confusion, eliminate irrelevant intangibles, and focalize on product or service in its right place in the customer's operation. Available on part-time or full-time basis. Prefers to locate in N. J. Me-973.

**Sales Engineer,** BSIE, extensive graduate work ME and Management; 34; U. S. citizen; ten years' broad experience technical assistance, management liaison, proposals, marketing, direct sales; mechanical, electromechanical, and some electronic equipment; fluent French and German, some Spanish; world traveled. About $10,000. Location immaterial. Me-974.

**Management or Sales Engineer,** graduate ME; 35; experience in metalworking, steam, hydraulic and heat engineering, and contractual pipework. Past three years as general manager overseas company, trebling sales. Excellent knowledge of world markets and major contract negotiation. $10,000. Foreign, particularly Europe, or U. S. Presently in Portugal. Me-975.

### San Francisco Office

**Sales Manager, Steel Fabrication, Machinery,** Bus. Admin.; 40; three years mechanical-engineering training; 14 years' experience as sales engineer in estimating, steel fabrication, machining, concrete products, electrical-wiring equipment. $11,000. Prefers West Coast. Se-1520.

**Designer, Development, Electronics, Electromechanical,** ME; 34; 11 years varied design and development of electromechanical components and products including manufacturing experience (plant facilities, production). $12,000. Prefers San Francisco Bay area. Se-1691.

**Mechanical Engineer,** ME; 69; 40 years' varied experienced in machine design and development, chemical and oil-refinery engineering, food industries, and steam engineering. Available for full or part-time services, consulting, invention evaluation. Prefers San Francisco Bay area. Se-1498.

**Project Engineer, Mechanical Design,** ME; 43; four years' experience as project engineer for heavy machinery manufacturer; 18 years in varied design assignments including machine, plant layout, piping, and economic studies. $9600. Prefers San Francisco area. Se-1671.

**Engineering Assistant, Mechanical,** recent graduate desires job in mechanical engineering as assistant technician, draftsman. Prefers San Francisco area or Calif. Se-1392.

**Chief Inspector, Construction,** ME; 53; ten years' experience in engineering inspection power-plant equipment, air conditioning in industrial plants in 25 states; four years' shipyard and repair experience; 12 years' foreign construction including inspection and training national engineers in petroleum industry. Prefers foreign location. Se-1103.

**Designer, Research, Development in Chemical or Manufacturing;** ME; 40; over 12 years design including, fabrication, installation, evaluation of process and production equipment; R&D on new products, plant layout, economic studies in chemical industry; design structural members, bridges, commercial and industrial buildings, heating and plumbing; design structural members for chemical-process building and apparatus, design of pumping, and heat-exchange systems. $15,000. Prefers San Francisco area; presently living in Tenn. Se-1444.

**Sales Engineer, Metalworking Machinery,** ME; 38; 15 years' sales experience in finishing and auxiliary metalworking equipment, standard and special for steel and nonferrous mills, price setting, equipment service, write advertising, and instruction manuals. $18,000–$20,000. Prefers San Francisco area; presently living in Pa. Se-1688.

**Designer, Metalworking, Welding Production Machinery,** mechanical background; 48; 25 years' experience in all phases of engineering of machine tools, resistance welding machinery, special production machinery, fixtures, tooling, automation, mechanical, hydraulic, pneumatic powered and manual to electronic and tape control. Supervisory experience. $10,000. An location. Se-1202.

**Sales Manager, Industrial,** ME; 45; 15 years' experience in manufacturing, quality control, design, research, development, sales in machine tools, gages, business machines, automotive engine parts, agricultural machinery. $14,000. Any location. Se-241.

**Plant, Product Engineer, Metalsworking;** ME; 38; solid academic training plus ten years' mechanical-equipment-design experience and supervision. Positions held at all levels of plant and product design, layout, development, and supervision of metal-shop production. $7200. Prefers San Francisco Bay area. Se-134.

**Instructor, Research, Electromechanical;** MS, ME; 31; two years design in aircraft navigational instruments; one year assistant in accoustical study of refrigeration compressors working with sound measurement. Studies of thermodynamic cycles, heat transfer, compressors; one year teaching engineering problems; two years' operating and maintenance hydrogen and nitrogen production facilities. $7500. Prefers East, West U. S., or Foreign. Se-182.

## Positions Available

### Chicago Office

**Power-Plant Operating Engineer,** graduate mechanical or electrical, to 40, minimum of four years' experience in steam-power-plant operations and maintenance. Would be second man in line for chief engineer's position. Good potential; food-products manufacturer. $8500–$10,000. Company pays fee. Southern Mich. C-8728.

**Plant Engineer,** mechanical or electrical graduate, 35–50; past work must indicate success in mechanical-maintenance supervision. Will be in charge of all mechanical maintenance in 23 buildings comprising 3,500,000 sq. ft. Responsible for three subordinate supervisors and 65 workers. Mechanical equipment includes 60 elevators, conveyers, plumbing and electrical systems, and miscellaneous machinery for catalog wrapping, addressing, printing, and transporting. Responsibilities include programming and scheduling work assignments, preparation of budgets, developing controls over cost and use of manpower, liaison with operating departments and contracting as necessary for outside work or services. Emphasis will be placed on applicant's administrative and supervisory ability; with a mail order company. To $10,500. Company pays fee. Chicago, Ill. C-8721.

**Assistant to Manager, Industrial Fan Department,** BS in engineering, at least four years' of sales experience in industrial, centrifugal and propeller fans, ventilators, and other blower equipment. Experience should be in both office and field sales. Duties will include development and guidance of sales activities, assistance to field offices on key accounts, keep informed of market and competitive activities, development and revision of product literature, and sales campaigns. Development of new industrial fan applications. $10,000–$12,000. Company pays fee. Midwest. C-8719.

**Mechanical Engineer,** BSME, experienced in gear-calculation load studies, stress analysis on gearing strength of material. Knowledge of lubrication. Good general design ability with materials used in consumer products. Open. Company pays fee. Ill. C-8711.

**Project Engineer,** mechanical or chemical-engineering graduate, to make calculations, prepare design sketches, co-ordinate all phases of engineering for construction, and modernization of pulp and paper mills. Client liaison

[1] All men listed hold some form of ASME membership.

for an engineering contractor. $10,000. Chicago, Ill. C-8706.

**New York Office**

**Director of Systems Engineering,** graduate mechanical or electrical, minimum of 12 years' experience, six of which should have been at a supervisory level. Duties and responsibilities will embrace all activities relating to the proposals and installation of communication systems. Will confer with industrial, educational, and government communications-systems salesmen; review estimates of cost and preliminary time schedule for engineering work and installation; maintain liaison with customers on matters of design, costs, schedules, revisions, and other matters. $12,000–$15,000. New York, N. Y. W-564.

**Manager of Engineering,** top administrator, ME degree, 35–45, experience in electromechanical devices in the solid fuels, rockets, missiles, or aircraft field. Must have experience in the preparation of bids and proposals and their presentation. $13,000–$15,000. Company pays fee. Eastern Pa. W-559.

**General Manager,** graduate mechanical or electrical, at least ten years' managerial, production, and engineering experience in wire and cable for electric-power use. $20,000–$25,000. New England. W-550.

**Production Manager** for a manufacturer of automatic fire-sprinkler equipment, degree in engineering, 35–40, a well-rounded background of machine-shop experience, familiar in the operation, set up, and maintenance of all standard shop and tool-room machine tools; well versed in modern methods and practice for machining, gaging, and assembling small and medium-sized bronze and iron castings. Will direct and supervise operation of production department consisting of approximately 40 employees, including the maintenance and improvement of machining, assembling, and testing methods and also quality control. $10,000–$12,000, plus excellent fringe benefits. N. Y. suburban area. W-549.

**Director of Marketing, Space Technology,** degree, preferably in engineering, math, or physics, experience as a general manager, division manager, marketing manager, chief engineer, or contracts administrator with companies selling aerospace programs to government agencies or prime contractors. $25,000–$35,000. New York, N. Y. W-548.

**Associate Professor, Mechanical Engineering,** PhD preferred but will consider an MS and consider experience. Teaching responsibilities will be in the areas of thermodynamics, energy conversion, and fluid mechanics. $9000 for nine-month academic year. South. W-537(a).

**Engineers** (*a*) Development engineer to direct project work in the development and evaluation of high-speed can-manufacturing equipment; should have experience in the construction and design of automatic production equipment, preferably can-manufacturing equipment. To $12,000. (*b*) Project director to head development of composite can program. Will be responsible for all phases of development including engineering work, experimental work on materials, and installation of production line; several years' experience in convolute and/or spiral winding equipment required. To $12,000. South. W-532.

**Quality-Control Engineer,** degree in mechanical, metallurgical, or welding engineering, five to 15 years' experience; manufacturing experience to include quality control, nondestructive test methods, and a knowledge of precision-measuring equipment. Requires meeting with vendor personnel at many levels to review manufacturing and quality-control functions. The ability to analyze, evaluate, and monitor quality-control systems is essential. Relocation and/or extensive travel may be required. To $10,800. Pa. W-529.

**Engineers.** (*a*) Cost engineer, graduate mechanical or civil, seven to ten years' practical experience in cost-engineering activities associated with the design and construction of electric-generating plants, transmission lines, process and industrial projects. Some travel. Open. (*b*) Estimator, graduate mechanical or civil, ten to 20 years' experience in engineering and estimating activities associated with electric-generating plants, transmission lines, process and industrial projects. Some travel. Open. Mass. W-520.

**Foundry Engineers.** (*a*) Assistant to general manager, knowledge of production foundry and precision methods, capable of assisting with selling, demonstrating; some technical writing. (*b*) Foundry process mechanization engineer to assume responsibility for co-ordinating design of automated molding and materials-handling equipment. Also supervise small production operation. Location for (*a*) and (*b*), New York Suburban area. (*c*) Senior foundry sales engineer, aircraft-foundry experience, to start up sales engineering operation, operating out of Los Angeles. W-519.

**Plant Engineer,** mechanical graduate, plant engineer service in multiunit chemical plant in construction, installation, and maintenance of equipment and facilities. Functions will include equipment selection, equipment design and specifications, parts inventory system, maintenance costs, preventative maintenance. Five to eight years' experience required. Reports to senior mechanical engineer. $8500. Ill. W-514.

**Staff Project Engineer,** graduate mechanical or chemical, five years' engineering experience with recognized manufacturer of printing and publications papers, including responsibilities in plant layout and cost estimating. Must be familiar with requirements for steam and electric power and have a knowledge of coating. Travel 40 to 50 per cent of time. $10,000–$12,000. Fla. W-511.

**Mechanical Engineers.** (*a*) Plant layout and methods engineer, recent graduate; no experience necessary. Position involves planning physical layout of machinery and equipment for most efficient production operations; also requires methods engineering development of new and improved manufacturing operations, standardization of equipment, materials, and working conditions. $6000–$6500. (*b*) Production trainees, business or engineering degrees, recent graduates, for a production-training program consisting of a series of guided assignments designed to prepare trainees for supervisory positions in production. About $5400. Company pays fees, interview, and relocation expenses. Va. W-508.

**Mechanical Engineer,** graduate, registered, to head mechanical section of a large consulting-engineering firm. Experience in central station power-plant design, heating systems, and air-conditioning systems required. Will do actual design and supervise small section of mechanical and electrical engineers as well as obtain new business. Open. Pa. W-501.

**Assistant to Manager, Industrial Fan Department,** 27-37, BS in engineering, four to ten years' of fan-sales experience, preferably including both home office and field-sales background. Should be familiar with industrial selling techniques, the field of industrial fan applications, and the development of new business and accounts. Responsibility will be the development and promotion of sales of a competitive line of industrial fan products, for industrial ventilation and industrial-process applications. $10,000–$12,000. Company pays fee. Midwest. W-449.

**Mechanical Engineer,** graduate, interest in thermodynamics; one to two years' experience either with a steam-turbine company, or in the power plant, or high-speed rotative equipment field, to do thermodynamic, vibration, and critical speed-analysis problems; will involve the diversified work of a small company. Conn. W-496.

**Project Engineer,** graduate mechanical preferred, 27–40, five to ten years' experience in the manufacture of insulated doors, hardware, for refrigeration. Product consists of insulated doors constructed of reinforced plastics, wood or metal, or wood-metal clad. Open. Eastern seabord. W-491.

**Engineers** for an international manufacturer, stable nondefense industry. (*a*) Chief manufacturing engineer, graduate or equivalent, heavy administrative experience and ability to get job done. Strong ability with stampings, tooling, processing, and automation in mass-production precision industry. To $11,000. (*b*) Manufacturing engineer, graduate or equivalent, heavy experience in light machining, stampings, assemblies, etc., in mass-production precision industry. Able to carry project through to completion. To $9000. (*c*) Senior tool designer thoroughly familiar with complex stampings, dies, jigs, fixtures, assembly tools, etc., in mass-production industry. Capable of making free-hand sketches used in building small tools. To $9000. Liberal and complete fringe benefit program. Pa. W-490.

**Director of Engineering,** graduate mechanical or electrical, 45–50, to be responsible for all product development and design of small electro-mechanical devices, especially small electrical switches. $18,000–$25,000. Company pays fee. New York Metropolitan area. W-489.

**San Francisco Office**

**Power-Plant Engineer, Thermal,** mechanical or electrical graduate, 35–55, qualified to handle client contact, develop new business, do engineering, supervise design. Thoroughly informed concerning thermal steam-power plants, gas, oil, coal. For a consultant-engineering builder. Submit past record of successful accomplishment. $15,000–$20,000. Headquarters, San Francisco Bay area. Sj-6084.

**Designers, Hydraulic Systems,** ME or MS, to 50, solid, recent top level, technical experience related to the use and applications of hydraulic or pneumatic pumps, motors, valves, piping, in over-all complex systems to satisfy clients needs; familiar with servo applications and other related control or actuator hydraulic components. For a manufacturer, fabricator, and installer of automatic equipment. $12,000, up. San Francisco East Bay. Sj-6257.

**Designers, Process Units,** mechanical, chemical, or electrical graduate, competent job or senior engineers in project group on refinery, chemical plants, or similar processing units, capable of responsible design in mechanical, chemical, or instrumentation. For an engineering-builder organization. $650–$900 a month. San Francisco. Sj-6241.

**Industrial Engineers, Electronics Components,** graduate industrial or mechanical. (*a*) Senior, to 45, minimum of five years' experience. (*b*) Associate, to 30, two years' experience. Will improve and modify manufacturing and cost, including advanced and principals for manufacturing vacuum tubes. Direct other engineers, draftsmen; design and develop production work places, tooling, equipment methods, estimate production standards; evaluate complex work simplification proposals and installation; analyze, recommend, evaluate method cost for new, modified plant layout plans, equipment and tooling; design, develop complex material handling systems, plant layout, maintenance systems, production advice and design standard package process. For an electronic device manufacturer. (*a*) $650–$800 a month; (*b*) $475–$575 a month. San Mateo County, Calif. Sj-6258.

**Designer, Grain-Handling Plants,** graduate mechanical, well qualified to handle equipment layouts for grain and feed mills and elevators, do plant engineering, prepare drawings, deal with clients and general contractors, knowledge of mechanical and electrical control, capable of dealing with financial and administrative end. For a long-established contractor. Opportunity to become affiliated with the firm. $750 a month. San Francisco, Calif. Sj-6298.

**Sales Engineer, Heating, Ventilating, Air Conditioning,** mechanical-engineering background, 24–40, some experience and sales ability, to sell air conditioning, heating, ventilating, air filtration, dust-control equipment to plant engineers, school superintendents and board, architects in developed territory. Car required! San Francisco Bay area resident required as job is in that area. $500–$700 a month. Sj-6264.

**Tool Designer, Small Parts,** mechanical background, to 50, six years' experience layout and design tool fixtures small parts manufacturing; able to plan, advise draftsmen; knowledge of metal fabrication, prepare working sketches, layouts, final design and drawings; information furnished by engineers and personal examination in conformance with shop; direct draftsmen for accurateness and consistency, check drawings, computations tolerances and adaptability to manufacturing, calculate complex mechanical tooling problems, assist in making man-hours studies; design jigs, fixtures, small parts, brazing, furnaces, welding. For an electronic device manufacturer. $575–$700 a month. San Mateo County, Calif. Sj-6261.

**Plant Engineer, Pulp and Paper,** graduate mechanical, 25–35, two years' experience preferably related to engineering department designs for modification of paper machinery and plant equipment. Familiar with material-handling systems, power transmissions, mechanical-structural elements, machines and machine shop (paper machines, converters, bags, printers, rewinders). For a large multiplant manufacturer of pulp and paper products. $550–$600 a month. North San Francisco Bay. Sj-6237.

**Management Trainee, Foods Containers,** engineering degree, 22–30. One year on-the-job training program duties in manufacturing and production departments. For a can-manufacturing division of a national foods company. $466 a month. Sacramento, Calif. Sj-6233.

**Production Engineer, Instruments,** IE or ME degree, minimum of five years' experience in manufacture of precision electromechanical devices. Minimum of two years' experience as a supervisor. Knowledge of machine-tool operations, processes, bearing characteristics, handling essential. Process new products from design to production, cost estimates, plant layout, packaging, improve manufacturing methods, establish work standards, select equipment. Open. Calif. Sj-6299.

**Designer, Pumps,** mechanical background, young, some experience in product design and development preferably related to board, shop, and applications on hydraulic pumping. For a national manufacturer of standard, specialty pumping and water systems (domestic, industrial, and irrigation). Open. San Francisco East Bay. Sj-6262.

**Plant Engineer, Chemical,** ME or ChE degree, to 40; recent graduate to seven years' experience, preferably in maintenance planning, controls or chemical-plant design, layout, material specifications, and estimating. For a chemical manufacturer. Must be U. S. citizen. Open. Western U. S. Sj-6248.

# CANDIDATES FOR MEMBERSHIP AND TRANSFER IN ASME

THE application of each of the candidates listed below is to be voted on after Aug. 25, 1961, provided no objection thereto is made before that date and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the Secretary of The American Society of Mechanical Engineers immediately.

## New Applications and •Promotions

### Arkansas

MAHAFFEY, JOHN E., Malvern

### California

FORSBERG, KEVIN J., East Palo Alto
HAILE, JAMES E., Fairfield
HOVANESSIAN, SHAHEN A., LaHabra
•PARKS, LEONARD B., c/o FPO San Francisco
PIERSOL, ALLAN G., Canoga Park
SCHLOSSER, MILES S., Goleta
SMOLEN, ALFRED M., Los Angeles

### Connecticut

JONES, RAYMOND N., Bridgeport
•LUBKIN, JAMES L., Springdale (Stamford)

### Delaware

CAMHI, JACK C., Wilmington

### Washington, D. C.

FARZANEH, DARIUSH

### Georgia

GREEN, BOBBY L., Atlanta

### Hawaii

THONG, KENNETH L., Honolulu

### Illinois

BENEDICT, GEORGE H., Washington
PERONTO, FRED, Chicago
PETERSEN, JOHN E., Chicago
PSICHOGIOS, THOMAS P., Orland Park
RENNER, ELMER J., Aurora

### Iowa

•DEEGAN, JAMES W., Iowa City
HELWEG, URBAN J., Des Moines
KITCH, PAUL E., Davenport

### Kentucky

GAEDDERT, THEODORE, JR., Ft. Thomas
•JOHNSON, MORRIS V., Louisville

### Louisiana

CALLOL, GABRIEL J., New Orleans
FARRELLY, DONALD F., Chalmette

### Maryland

MCCLAREN, SAMUEL W., Linthicum Heights
•PAPUCHIS, CHARLES J., Silver Spring

### Massachusetts

FREESTON, WILLIAM D., JR., Westwood
MARINO, PASQUALE A., Boston
•MORSE, EARL P., Quincy

### Michigan

SAYERS, EDWARD J., Saginaw
HOWLAND, GEORGE R., Dearborn

### Minnesota

KUMAR, DEVENDRA, Minneapolis
WHEELER, RAY B., Rochester

### Nebraska

•PRICE, JAMES H., Ralston

### New Jersey

AIMONE, ROBERT J., So. Plainfield
DONAHUE, RAYMOND R., Haddonfield
HANAY, JOSEPH J., Englewood
PERELLI, CHARLES A., Madison
RANDECKER, JOHN W., Springfield

### New York

BENNETT, ROWLAND K., Bayside
•BERMAN, KURT, Schenectady
CATOR, EDWARD J., Rochester
FLORSER, JOHN J., Albany
HOH, FRANCIS KIA-CHUN, Ossining
KREBS, NEIL E., Bellerose
LLEWELLYN, JOHN K., Olean
O'BRIEN, DONALD W., New York
SHRIRO, MORRIS A., Mt. Vernon
•TERRANOVA, FRANK J., New York

### North Carolina

SCHMIDT, GUENTER H., Charlotte

### Ohio

BECK, LAWRENCE O., Rocky River
BENTZ, CHARLES E., Dayton
JAFFAR, ABDUL, Cleveland
•STEVENSON, KENNETH W., Mt. Vernon

### Oklahoma

COVELL, KENNETH A., JR., Tulsa
•WALLER, EDWIN J., Stillwater

### Oregon

•REESE, RUSSEL D., Portland

### Pennsylvania

FERRIE, PARMELY T., Pittsburgh
HUTT, GEORGE R., 3RD, Philadelphia
•NICHOLS, OMER W., Latrobe
PFAHLER, STEPHEN L., Pittsburgh
SMITH, BRADFORD D., Gladwyne
VIGH, ZOLTAN, Philadelphia
WINTRISS, GEORGE, Carversville

### South Carolina

LOPER, RAYMOND H., Greenville

### Tennessee

ZIMMERLE, JOHN R., Memphis

### Texas

BRADEN, PATRICK O., Houston
•CANTWELL, GUY D., Dallas
•SKIDMORE, KENNETH L., Houston
WILLIAMS, LEONARD E., JR., Houston

### Utah

BOYD, KEITH E., Salt Lake City

### Vermont

Kennison, Robert E., Burlington

### Foreign

ARROYAVE, EDWARD A., MARACAIBO, ZULIA Venezuela
•GARRET, ANDRE, Saint John, N.B., Canada
GIBSON, WILLIAM L., Niagara Falls, Ont., Canada
HARRIS, JAMES J., Toronto, Ont., Canada
IYOI, HITOSI, Narasino City, Chiba Pref., Japan
LYONS, JOHN J., Toronto, Ont., Canada
•MCDERMAND, ROBERT F., Windsor, Shad. W., Ont., Canada
SKORINA, GEORGE A., Westmount, P.Q., Montreal, Canada
SZIRTES, THOMAS, Montreal, Canada

•Promotion to Member or Affiliate

# OBITUARIES

**Edson Lockwood Barlow** (1902–1961), plant engineer, Belding-Heminway Co., Inc., Putnam, Conn., died, Jan. 10, 1961. Born, Ossining, N. Y., Oct. 31, 1902. Education, EE, Rensselaer Polytechnic Institute, 1924. Mr. Barlow was a public-utility inspector with Northern Westchester Lighting Co., Ossining, N. Y., for two years after graduation, and then entered the family business, Barlow and Co., in hardware and paints. Continuing in this line, he went with E. V. Grant Estate, Poughkeepsie, N. Y., in 1928, and was a sales manager there until 1942, when he joined the Fagan Electric Co., Little Rock, Ark., as project superintendent on electrical construction. Between then and 1949, when he went with Belding-Heminway Co., he also was planning manager with Bart Laboratories, Belleville, N. J., manufacturer of reflectors and floodlights; and engineer on factory planning with Western Electric Co., Kearney, N. J. Mem. ASME, 1951. He was a member of the Montclair (N. J.) Society of Engineers.

**Edmund Dana Campbell** (1881–1960), retired vice-president in charge of engineering, American Car and Foundry Co., died, Oct. 27, 1960. Born, West Nanticoke, Pa., May 24, 1881. Education, BS, Pennsylvania State College, 1903; ME, 1907. Mr. Campbell served a short apprenticeship in the steel-car shops of the American Car and Foundry Co., Berwick, Pa., after graduation. Then he went to work in the company's engineering department at the Berwick plant and later at Milton, Pa., and in New York City. He went to Montreal, Que., in 1908, to join the Canada Car Co., returning a year later to the American Car and Foundry Co., St. Louis, Mo., where he was until 1917. During World War I, he was commissioned Captain in the Engineer Officers Reserve Corps and later was assigned to the Engineering Division of the Ordnance Department in Washington, D. C. In 1919, he was commissioned Lieutenant-Colonel in the Ordnance Reserve Corps; and in 1931 was made a Colonel. After his discharge from the U. S. Army in 1919, Mr. Campbell returned to the American Car and Foundry Co. as assistant engineer in the New York office, and in 1925, when the St. Louis plant was expanding, he went to St. Louis to organize the mechanical department. He was appointed to the post of assistant general mechanical engineer at the Berwick plant in 1933, becoming general mechanical engineer in 1938. He authored several articles on railway artillery and equipment. Mem. ASME, 1916; Fellow ASME, 1946. He was a member of the General Committee of the ASME Railroad Division, and was on the Division's Executive Committee in 1947. He was a director of Sterling Steel Castings, and a member of the Army Ordnance Association, the Railroad Machinery Club, and the New York Railroad Club.

**George W. Codrington** (1886–1961), retired vice-president of General Motors Corp., died, Daytona Beach, Fla., April 26, 1961. Born, Palatka, Fla., Dec. 22, 1886. Education, public schools and tutors. A specialist in marine engineering, Mr. Codrington had 15 years' experience at sea as an engineer on various ships. In 1914-1915, he was chief engineer on the yachts *Everglade* and *Paragon*. He became general manager of the Winton Engine Corp., Cleveland, Ohio, in 1919, and was named vice-president in 1925, and president in 1928. He was closely identified with the growth and development of the firm as one of the nation's leading makers of marine and industrial engines. When General Motors acquired Winton as a subsidiary in 1930, Mr. Codrington continued to direct its affairs as president and general manager. He took the title of general manager in 1938, when Winton became the Cleveland Diesel Engine Division of General Motors. He was elected a General Motors vice-president in 1942. He also was director of Addressograph-Multigraph Corp., Cleveland; Allied Products Corp., Detroit; Electric Boat Co., Groton, Conn.; and National Acme Co., Cleveland. He retired in 1952. Mem. ASME, 1929. He was a former president of the National Association of Engine and Boat Manufacturers, sponsors of the annual National Motorboat Show, and was a member of the Society of Naval Architects and Marine Engineers. Surviving is his wife, Gladys.

**Harry Shipp Coleman** (1886–1961), retired director of engineering, Mellon Institute of Industrial Research, Pittsburgh, Pa., died, April 29, 1961. Born, Colony, Kan., July 30, 1886. Parents, Charles S. and Emma Jane (Fisher) Coleman. Education, BS(ME), Univ. of Kansas, 1909; ME, 1939. Married Amy Wolfe, 1914; children, Charles Wolfe and Carmie Jane. Mr. Coleman was with Mellon Institute for 38 years before retiring in 1956. He joined the institute as assistant director and assistant secretary-treasurer in 1918. He worked extensively on the design of new laboratory buildings, and had administrative charge of the provision and maintenance of all research facilities and general services, and of the numerous factors associated with the management of the institute's building. He also was business manager of the University of Pittsburgh from 1922 to 1926. From 1939 to 1956, he was chairman of the National Research Council's Committee on Design, Construction, and Equipment of Laboratories, an activity that led to the production of a treatise entitled "Laboratory Design," issued in 1951. He also wrote two other

brochures on research laboratory design, erection, and equipment. In 1950, he was a member of the Site Selection Committee for the Quartermaster Research Laboratory of the U. S. Department of Defense. Before joining the institute, Mr. Coleman was an engineer with Jacobs-Shupert U. S. Firebox Co., New York, N. Y., and Lukens Steel Co., Coatesville, Pa. Mem. ASME, 1918. Coleman was a member of AAAS, Sigma Xi, Tau Beta Pi, National Association of Purchasing Agents, and the National Association of Educational Buyers. He was a registered professional engineer in the Commonwealth of Pennsylvania.

**Floid Merrill Fuller (1883–1961),** retired distribution engineer for Pennsylvania Power and Light Co., died, Bethlehem, Pa., April 20, 1961. Born, Scranton, Pa., Sept. 4, 1883. Parents, Arthur C. and Clara (Woolworth) Fuller. Education, BS(ME), Massachusetts Institute of Technology, 1906; BS(EE), 1908. Mr. Fuller joined the Pennsylvania Power and Light Co. in 1923 and remained with them for 25 years, retiring in 1948. During World War I, he was an assistant inspector with the Office of Naval Inspector of Ordnance, Bethlehem Steel Works, South Bethlehem, Pa. Before the first war, he was associated with the Duluth Show Case Co., Duluth, Minn., and then did consulting engineering work. Jun. ASME, 1907; Assoc.Mem. ASME, 1917; Mem. ASME, 1919. He was a member of AIEE, NSPE, and the Engineers Club of the Lehigh Valley. Surviving is his wife, Frances (Tompkins) Fuller; a son, Robert M.; a daughter, Mrs. Marion Moody, Tampa, Fla.; and a brother, Howard A. Fuller.

**Leonard Ernest Glover (1905–1961),** senior lecturer in management studies at Woolwich Polytechnic, Woolwich, London, England, died, April 8, 1961. Born, Ilford, Essex, England, Jan. 22, 1905. Education, Higher National Certificate in Engineering, Woolwich Polytechnic (Branch of London Univ.). Mr. Glover worked as a draftsman with several London engineering firms before becoming an assistant engineer with The British Acetate Silk Corp., Suffolk, England, in 1929. In 1930, he joined R. W. Munro, Ltd., London, as chief draftsman, and worked there for ten years, chiefly on precision instruments such as air-speed indicators for aircraft, and dynamometers, inner drives, and propeller and ship model cutting machines. He did special work for the British Admiralty, Air Ministry, War Office, and other departments of the British government. It was his work with precision gages—which he also did for The Plessey Co., Ltd., Ilford, Essex, and the Pitter Gauge and Precision Tool Co., Ltd., Woolwich—that brought him into contact with Woolwich Polytechnic, where he lectured from 1946 until his death. He helped to pioneer management studies there. He helped prepare articles for publication in a number of periodicals and several books, and held some patents. Mem. ASME, 1947. He was a member of The Institution of Mechanical Engineers and the Institution of Production Engineers.

**John Sobieski Haug (1883–1961),** retired consulting engineer, United Engineers and Constructors, Inc., Philadelphia, Pa., died, April 20, 1961. Born, Norristown, Pa., April 23, 1883. Parents, John Henry Christopher and Ida Alpha (Lowe) Haug. Education, BS(ME), Univ. of Pennsylvania, 1904; ME, 1907. Married Mary Eleanor Pearson, 1917; one son, John Rowland Haug. Mr. Haug was an author and authority on the manufacturing of gas. He began his career in 1904 with the United Gas Improvement Co., Philadelphia, and worked successively with the Montreal Light Heat and Power Co., 1909–1917, and the U. G. I. Contracting Co., 1917–1928, before going with the United Engineers and Constructors, Inc. He supervised the design of gas works and developed new types of gas apparatus. In 1937, Mr. Haug received the Edward Longstreth Medal of The Franklin Institute for the development of a water-gas generator. He also held the Award of Merit from the American Gas Association for 1956. He held many U. S. and foreign patents on processes and equipment for gas manufacture. Among these were Belgian, Canadian, French, British, Dutch, and Italian patents. He also wrote many articles before his retirement in 1955. Mem. ASME, 1927. He was chairman of the ASME Subcommittee on Gas and Air Piping from 1937 to 1946; and was a member at large of the Code for Pressure Piping, ASA B31, from 1926 to 1946. He was a member of the American Gas Association, and was chairman of the Advisory Committee to the Bureau of Mines on Survey of Gas Coke and By-Product Making Properties of American Coals, from 1927 to 1953. He also was a member of the Canadian Gas Association and the Canadian Society of Civil Engineers, and was a registered professional engineer in Pennsylvania since 1923. Surviving are his wife, Mary; son, John R.; and three grandchildren.

**Frederick Carl Heinen (1898–1961),** vice-president, The Youngstown Steel Door Co., New York, N. Y., died, Greenwich Hospital, Conn., May 8, 1961. Born, New York, Oct. 22, 1898. Education, ME, Stevens Institute of Technology, 1920. Mr. Heinen worked for the Southern Pacific Co., New York, for three years after graduation, and then joined the Camel Co., which was purchased by Youngstown Steel Door Co. in 1934. The company manufactures railway supplies. Assoc. Mem. ASME, 1921. Mem. ASME, 1949.

**William J. Kunz (1893–1961),** retired engineer, died, April 22, 1961. Born, St. Louis, Mo., Sept. 24, 1893. Parents, William and Anna Kunz. Education, attended Columbia Univ. Married Irma Fink, 1917; children, William J. Jr., Robert Calvin, and Warren. Mr. Kunz was with Combustion Engineering, Inc., from 1926 to his retirement. He was manager of drafting and engineering production concerning steam-generating units, including some of the world's largest boilers, stokers, and pulverized fuel installations. He had previously worked as assistant chief engineer of the Dry Milk Co., New York, from 1919 to 1926, and before that was resident engineer of construction for the Air Reduction Co. He also worked with the Otis Elevator Co., Yonkers, and with Griscom-Spencer Co. He authored an article entitled "Production Management Applied to the Drafting Department," which appeared in the *Transactions of the ASME* in 1932, as well as other descriptive articles. Jun. ASME, 1916; Assoc-Mem. ASME, 1919; Mem. ASME, 1935. He served on ASME Codes and Standards committees. He was a registered professional engineer in New York State. Surviving is his wife, Irma.

**Ian MacLeod (1917–1961),** technical director, Stockdale Engineering, Ltd., Poynton, England, died, March 18, 1961. Born, Brighton, Sussex, England, April 11, 1917. Education, graduate, Greenwich Central, 1933. A specialist in the design of high-speed machinery and processing equipment, Mr. MacLeod worked with a number of companies during his career. He became chief draftsman in 1939 with Mass Tools, Ltd., in Cheam, Surrey, England, designing production equipment. In the following years, he held the same position with Production Tooling Units, Ltd., and with Premier Colloid Mills, Ltd., and then traveled to the U. S. A. in 1950 to be chief engineer for the Premier Mill Corp., in Geneva, N. Y. Later, he returned to England to join Stockdale Engineering, Ltd. For his paper, "Use of Plastics in Production Engineering," he received the Lord Austin Prize for the best paper of the year 1945 from the Institution of Production Engineers, of which he was a member. Mem. ASME, 1953. His wife survives.

**Edward Barrington MacNab (1907–1961),** manager, sales, Supply Center, Owens-Corning Fiberglas Corp., Tampa, Fla., died, March 21, 1961. Born, Nashville, Tenn., Oct. 6, 1907. Education, extension courses. Mr. MacNab worked on the design and standardization of Vermiculite products for the construction and insulation industries. He served as technical director of the Perlite Institute of America, and worked on standards and engineering data for the use of Perlite, a natural glass, in the construction industry. He also designed and constructed Vermiculite processing plants for companies that included the California Vermiculite Corp., the Standard Insulation Co., Inc., the Mission Lime Products Co., and the Pacific Vermiculite Corp. He was chief engineer and general manager of the Standard Insulation Co., Inc., from 1939 to 1945, and then general manager of MacNab and Co., Inc. He also was associated with the Panacalite Pacific Co. before joining Owens-Corning in Los Angeles, Calif., in 1952. He held a patent on a lightweight insulating brick. Mem. ASME, 1957. He was a member of the American Institute of Management, the Institute of Sales Research, and the Construction Industries Committee of the Los Angeles Chamber of Commerce. He held licenses in the State of California for industrial insulation contracting and for the construction of industrial buildings.

**Arthur Frederic Murray (1884–1961),** retired vice-president in charge of manufacturing for the Electrolux Corp., died, Old Greenwich, Conn., May 10, 1961. Born, Bethlehem, Pa., August 20, 1884. Parents, George and Elemina (Yost) Murray. Education, ME, Lehigh Univ., 1905. Married Barbara A. Gilman, 1917; children, Jeannette, Barbara, Gilman, and Marion. Mr. Murray was with Westinghouse Electric and Manufacturing Co. from 1919 to 1943, when he joined Electrolux Corp. as works manager. During his years with Westinghouse, he pioneered in the development of methods for mass production and materials handling in radio-set manfacture, and in the manufacture of small motors, and other electric appliances. He helped to organize production of the Westinghouse refrigerator, one of the first hermetically sealed designs. In the Westinghouse Porcelain Insulator Plant, he helped develop air-conditioning units for railroad cars as well as controlled ceramic-drying equipment. Mr. Murray came to Westinghouse with a background as a production engineer in time study, machine design, and plant layout. He began his career in 1905 with the Remington Arms Co., Ilion, N. Y., and subsequently worked with Elliott-Fisher Typewriter Co., Harrisburg, Pa.; Blake Knowles Steam Pump Co., East Cambridge, Mass.; and the International Steam Pump Co., St. Paul, Minn. Mr. Murray's first contact with Westinghouse was in 1916, when he had charge of time study and scrap-reduction incentive plans for World War I munitions production at the New England Westinghouse Co., a munitions subsidiary. During the first years of World War II, before he left the company in 1943, he worked with the Special Defense and War Product Sales assisting in preparations for production of projectiles, gun mounts, binoculars, fuses, torpedo-control engines, and other special products. With Electrolux during the closing years of the war, he had charge of producing many types of small motors for U. S. Army Ordnance, Signal Corps, Chemical Warfare Service, U. S. Air Corps, and the U. S. Navy. At the war's end, the company reconverted to production of the Electrolux Vacuum Cleaner. Mr. Murray became vice-president in charge of engineering in 1953, and retired in 1958. He held the Service Award of ASTE and the Lehigh University Alumni Award for 1952. He was the author of numerous technical papers and articles on plant layout and manufacturing, some of which appeared in MECHANICAL ENGINEERING, the *Transactions of the ASME*, *Westinghouse Magazine*, *Mechanical World and Engineering Record*, *Mill and Factory*, *Canadian Machinery*, and other magazines. Jun. ASME, 1908; Assoc-Mem. ASME, 1915; Mem. ASME, 1919; Fellow ASME, 1953. He worked on the Quality Control Subcommittee of the ASME Management Division, 1934–1935. In 1949, he was chairman of the Production Engineering Division and, from 1948, was chairman of the Committee on Standards of Accuracy of Engine and Tool-Room Lathes. He was ASME representative on the ASA Committee B5, Small Tools and Machine-Tool Elements, since 1940; and was vice-chairman of the committee from 1948 to 1951. He also held membership in Tau Beta Pi, the Engineers Society of Central Pennsylvania, the American Foundrymens Association, ASTE, National Association of Steam Engineers, AOA, and was a charter member of the Engineers' Society of Western Massachusetts. Surviving is his wife, Barbara, three daughters, Mrs. John A. Brown, Mrs. John C. Topping, and Mrs. William R. Denstel; two sons, Gilman Y. and William D. Murray; and three sisters.

**Frank Bennie Stillo (1923–1961),** design engineer, The Timken Roller Bearing Co., Canton, Ohio, died, May 7, 1961. Born, Canton, Ohio, Feb. 4, 1923. Education, BME, Ohio State Univ., 1948. Assoc. Mem. ASME, 1948.

**Adolph Gustav Syska (1889–1961),** consulting engineer, died, San Antonio, Texas, May 10, 1961. Born, New York City, Aug. 21, 1889. Parents, Adolph G. and Katherin (Stapelfield) Syska. Education, ME, Columbia Univ., 1913. Married Elsie Mahler, 1919; children, Edna Lorna and Robert Edward. Mr. Syska designed the mechanical systems of the United Nations headquarters and of other buildings in New York City. He also designed structures at the U. S. Air Force Academy in Colorado Springs and the Brooklyn Supreme Court building. He was a member of the firm of Syska and Hennessy, which he formed with John F. Hennessy in 1928. He retired from the firm in 1955, while retaining a contract with it to act in an advisory capacity, and continued in private consulting practice. He began his career in the Pennsylvania Railroad station in New York City, working with Gibbs and Hill, consulting engineers, and later went to work for the New York Central Railroad at Grand Central Terminal. From 1921 to 1927, he was with the consulting engineering firm of Clyde R. Place, working on heating, ventilating, and power-plant design. He was a director of the Lawrence Park Heat Light and Power Co., and of Engineering Management Corp. Jun. ASME, 1918; Assoc-Mem. ASME, 1918; Mem. ASME, 1933. He was a past-president of the New York Association of Consulting Engineers, and a member of AICE and ASHRAE. He is survived by his wife, Elsie; a son, Robert; a daughter, Mrs. Edna Peltier of San Antonio, Texas; a sister, Mrs. Hilda Holtermann; a brother, William; and five grandchildren.

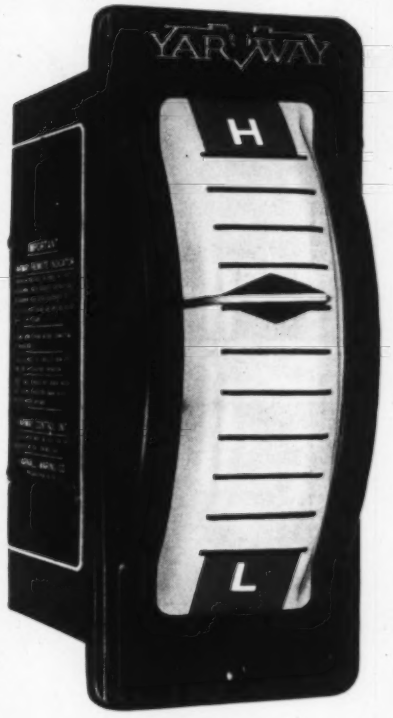
**Robert Walter Ulrich (1918–1961),** senior project engineer, Delavan Mfg. Co., West Des Moines, Iowa, died, Rivera Beach, Fla., April 7, 1961. Born, Shillington, Pa., April 16, 1918. Parents, Ruth and Edward Ulrich. Education, BS, Santa Clara Univ., 1944; attended Drexel Institute of Technology. Mr. Ulrich joined Delavan Mfg. Co. in 1949 as a design engineer, becoming project engineer in 1955 and senior project engineer in 1958. He was a specialist in the design of fuel injectors and spray nozzles for gas-turbine engines, and he designed fuel injectors that are now standard on the most advanced jet aircraft and missiles. Mr. Ulrich began his career in 1940 with Birdsboro Steel Foundry and Machine Co., Birdsboro, Pa. Later, he joined the Globe Hoist Co., Philadelphia, where he supervised design work on installations of hydraulic elevators. He also was associated with the ITE Circuit Breaker Co., Philadelphia. Mem. ASME, 1959. He was a member of the American Society for Metals. Surviving are his wife, Sydne June; his father, Walter F. Ulrich; and a brother, Edward W.

YARWAY news briefs

*from* **Yarnall-Waring Company,** *Philadelphia 18, Pa.*

*BRANCH OFFICES IN 19 UNITED STATES CITIES • SALES REPRESENTATIVES THROUGHOUT THE WORLD*

# PROVEN DEPENDABILITY




## MORE THAN 16,000 INSTALLATIONS ATTEST TO SUCCESS OF YARWAY REMOTE LIQUID LEVEL INDICATORS

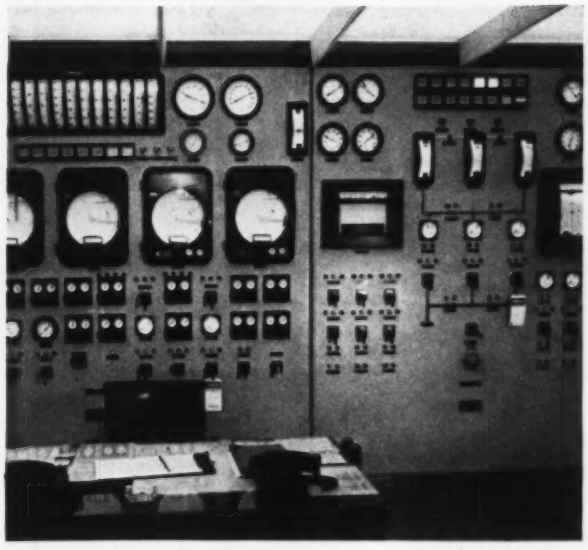
Widespread use of remote liquid level indicators for boiler water level applications, many within ASME Boiler Code requirements as they pertain to installations over 900 psi, have focused attention on the outstanding service record of Yarway Indicators.

*More than 16,000 Yarway Remote Liquid Level Indicators are in successful service throughout industry — hundreds are operating in place of one of two required gage glasses on higher pressure boilers as permitted by the code.*

Briefly, these features are responsible for Yarway Indicator's dependability—and success:

- Readings are *instant* and *accurate* because indicator is operated by the boiler water itself
- Pointer mechanism is never under pressure
- Brilliant, wide-vision dial makes readings easy from any point in a 180° arc around the indicator—and at considerable distances

Write for Bulletin RI-1825 (pressures to 700 psi), or Bulletin RI-1826 (over 700 psi).



*Four Yarway Remote Liquid Level Indicators installed at new Mid-West utility.*

## A FEW TYPICAL USERS

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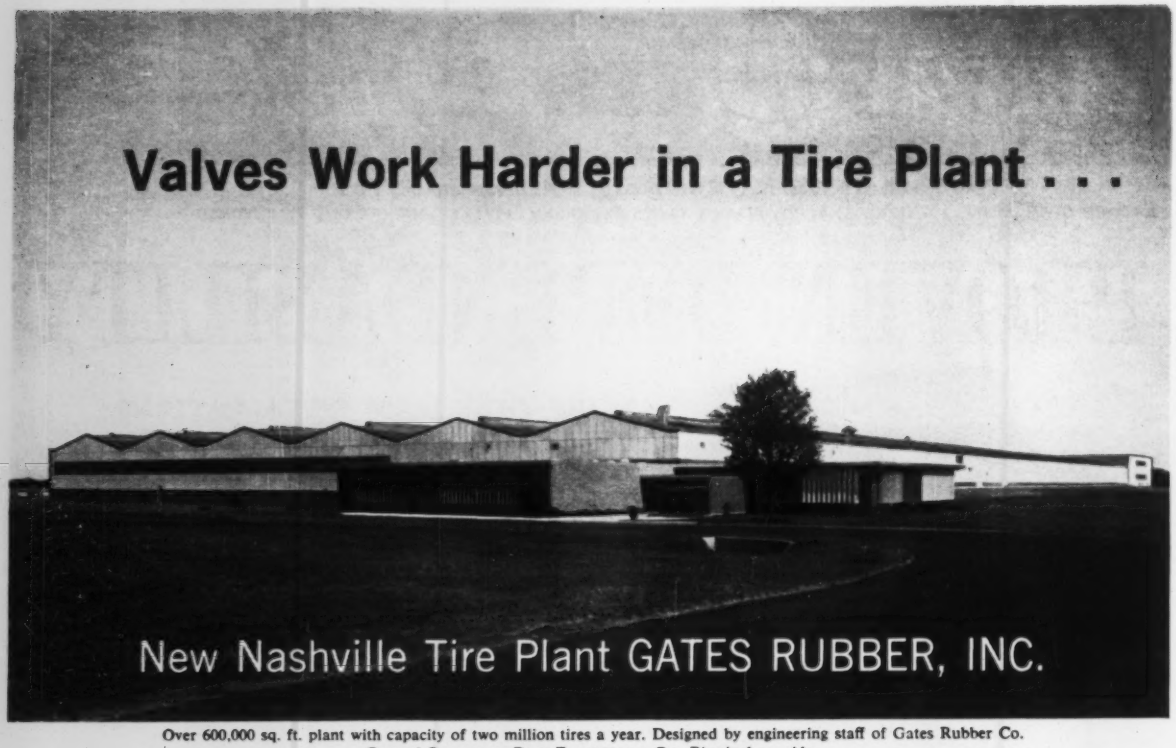
REPUBLIC STEEL CORP.
FORD MOTOR COMPANY
UNION BAG & PAPER COMPANY
WESTINGHOUSE ELECTRIC CORP.
GENERAL ELECTRIC COMPANY
STAUFFER CHEMICAL COMPANY
WILSON & COMPANY
U. S. STEEL COMPANY
GENERAL MOTORS
MOBIL OIL COMPANY

**UTILITIES**

COMMONWEALTH EDISON
IOWA ILLINOIS GAS & ELECTRIC
CENTRAL ILLINOIS PUBLIC SERVICE
ILLINOIS POWER CO.
WISCONSIN POWER & LIGHT
LAKE SUPERIOR DISTRICT POWER
NORTHERN STATES POWER CO.
PUBLIC SERVICE OF INDIANA
INDIANAPOLIS POWER & LIGHT
IOWA ELECTRIC LIGHT & POWER
NEBRASKA POWER
NEW ENGLAND POWER
ROCHESTER GAS & ELECTRIC CO.
PENNSYLVANIA ELECTRIC CO. (ERIE, PA.)
OMAHA PUBLIC SERVICE
CENTRAL ILLINOIS ELECTRIC
NARRAGANSETT ELECTRIC CO.
LOUISIANA POWER & LIGHT
HARTFORD ELECTRIC LIGHT CO.
POTOMAC ELECTRIC POWER CO.

Circle No. 142 on Readers' Service Card

# Valves Work Harder in a Tire Plant . . .



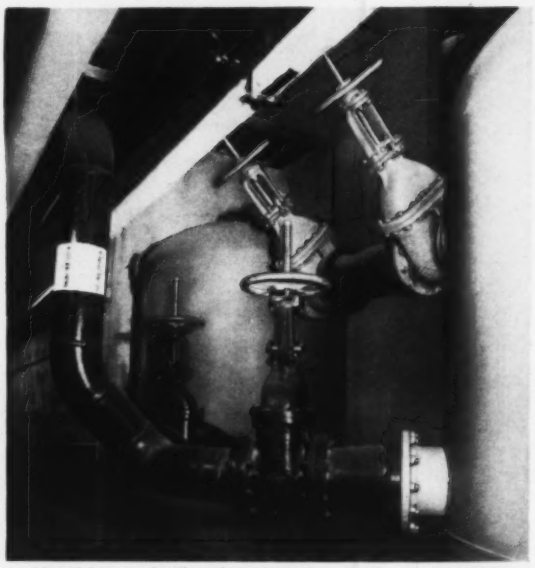

Over 600,000 sq. ft. plant with capacity of two million tires a year. Designed by engineering staff of Gates Rubber Co.
*General Contractor:* RUST ENGINEERING CO., Birmingham, Ala.

## GATES specified the valves that stand hard work, longer . . . JENKINS VALVES

Because high pressure steam, compressed air and water play a big part in making auto and truck tires, valves work unusually hard in this new Gates Rubber plant near Nashville, Tenn.

To be sure of valves that would stand such punishing service, Gates Rubber called for Jenkins Valves. And, with 2500 of them controlling processing and service lines, Gates can look forward to substantial savings in valve maintenance and replacement costs.

Your job for valves may not be so tough, but the extra-quality of Jenkins Valves is well worth specifying . . . especially since you pay no more for it. It's true . . . Jenkins Valves not only *cost less* in the long run.— they *cost no more* to buy. Jenkins Bros., 100 Park Ave., New York 17.



Jenkins Valves controlling air system at constant pressure of 90 lbs.

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MOST TRUSTED TRADEMARK IN THE VALVE WORLD
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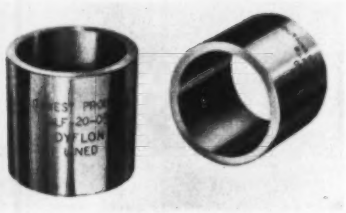
# KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Available literature or information may be secured by using convenient Readers Service Card on Page 153

NEW EQUIPMENT



## Journal Bushings

Self-lubricating, plain, journal bushings capable of dynamic loads to 25,000 psi and static yield loads to 50,000 psi at low rotational speed without damage are being offered by Southwest Products Co.

Stainless-steel housings are employed and the bushings have a plastic-alloy insert made of "Dyflon." This same material has been used in the manufacture of Dyflon Monoball, plain spherical bearings for over three years. Bore sizes are from $1/4$ to 3 in.

The company states that the life of these journal bushings at unit loading of 10,000 psi or less, with moderate surface speeds, is practically unlimited. At highest dynamic loading, no galling, fretting or brinelling will occur. At highest unit loading, a PV of 50,000 can be handled satisfactorily, but a velocity in excess of 150 fpm should not be exceeded. —K-1

## Exhaust Heat Exchangers

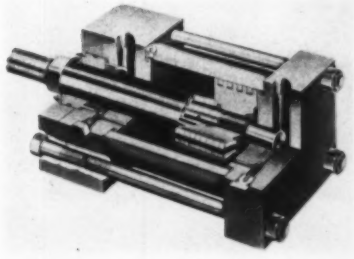
Exhaust heat exchangers are available now in stock sizes, according to an announcement from Engineering Controls, Inc. The exchangers are used to produce steam, heat water or process fluids in conjunction with vapor-phase cooling systems on internal-combustion engines.

The stock size units, available for vertical or horizontal mounting, are designed to meet the requirements of any engine plant. The exchanger can be supplied with or without silencing elements to meet commercial or residential requirements. Silencing may be an integral part of the exchanger or supplied as a separate unit. —K-2

## Shaft Extension

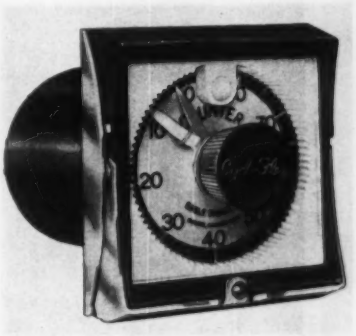
PIC Design Corporation, now has available from stock, an improved series of precision shaft extensions. Designed, basically, to extend working length of like-size shafts, these precision units may be used also as adapters to standardize shafts of unlike diameters.

Precision machined from No. 303 stainless steel with clear passivated finish in $1/8$, $3/16$ or $1/4$-in. shaft sizes, the extensions are furnished with the same size male and female ends or in any combination of these sizes. Over-all length of extension is $1\frac{5}{8}$-in., providing for one full inch of usable shaft surface. All diameters are concentric to 0.0005 in. —K-3



## Hydraulic Cylinders

An improved series of "interchangeable" hydraulic cylinders, $1\frac{1}{8}$ through 14-in. bores with 18 mountings, for operation up to 3500 psi has been announced by the Sheffer Corp. in Bulletin 261. Known as Sheffer's HH Series, these rugged cylinders meet or exceed JIC standards, feature tie-rod construction for maximum strength and shock loading, long wearing easily maintained rod cartridges, removable with only a wrench, and four different types of piston packing for various applications. Heads, retainers and mountings are of machined steel. Cylinder tubes are micro-finished seamless steel, sealed with O-rings placed to completely eliminate extrusion. Piston rods are 110,000 psi high-tensile steel, hard-chrome plated by a special process to insure smoothest possible surface and excellent corrosion resistance. Rod wipers are of Teflon, designed to keep rods clean and dry for maximum service life. Rod packing is low friction, self-adjusting, long-wearing multilip type. Pistons are one-piece fine-grain-alloy cast iron, threaded and pinned to the rod. Sheffer-originated tapered cushions eliminate cushion adjusting screws, provide positive gradual deceleration and eliminate shock upon entrance of cushion piston. —K-4



## Impulse Counter

Eagle Signal Company (Bulletin 725) "Cycl-Flex" counter is designed to open or close a switch after a present number of counts. It is spring rest to O making it applicable to completel automatic control circuits which must function from counts.

The counter is furnished complete with its own plug-in case. The case is permanently mounted and wired to the application. Designed primarily for flush mounting, this case is installed by cutting one $3\frac{1}{8}$-in-diam opening. All terminals and wiring information are conveniently located on the rear of the case. The counter mechanism may be removed and replaced in the permanently mounted case at any time in 5 sec or less. The Bulletin 725 counter features its own handle lock to insure a positive dust and oil-resistant seal.

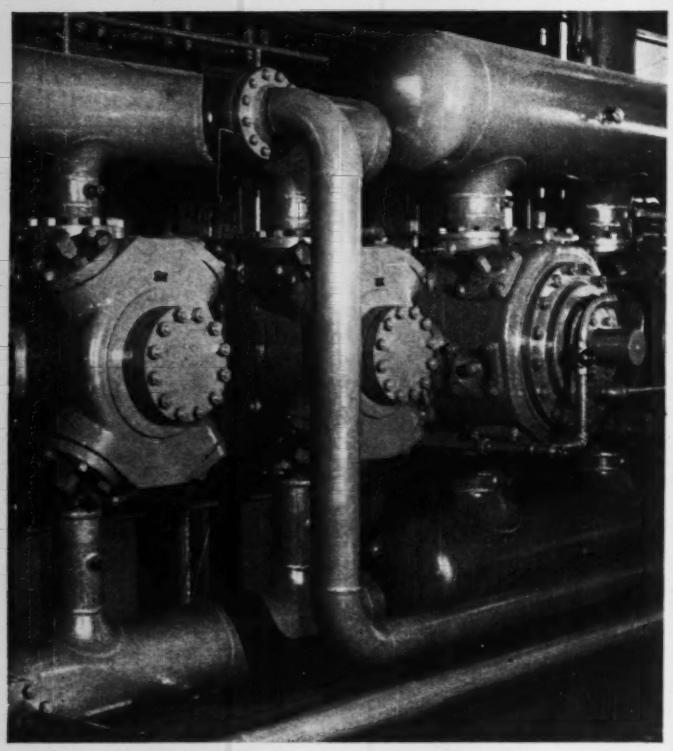
The Bulletin 725 has a maximum count speed of 400 counts per min. Its count range is 80 counts. It is designed for an optimum 15,000,000 counts (mechanical life). —K-5

## Airborne Blower

Globe Industries, Inc. has announced a vaneaxial blower, VAX-4.5, which will deliver 140 cfm of air against a static pressure of 5 in. of water at 25,000 ft. Sea-level output is 77 cfm of air against 5 in. of water. Characteristics of the motor are such that no pressure sensing or speed-regulating switches are needed in the system, from sea level to rated altitude. Motor is wound for 200 volts ac 400 cycles, 3 phase; other power requirements can be met, including dc and universal ac/dc. VAX-4.5 is $4\frac{11}{16}$ in. diam by $3\frac{1}{2}$ in. long, and weighs $5\frac{1}{2}$ lb.

The unit is designed to meet all appropriate MIL specifications and is rated for 1000 hr life at 110 C ambient. —K-6

PACKAGED
COMPRESSOR PIPING...



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Designed to eliminate all notch effects, the Bonney Sweepolet provides optimum stress distribution for critical piping systems such as the compressor bottles shown above on Worthington SLHC-10 gas engine angle compressors rated at 950 BHP each. These units were fabricated by Worthington-Lockett using Bonney Sweepolets for branch construction. Specify and use Bonney Sweepolets in your critical piping systems.

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# KEEP INFORMED

BUSINESS NOTES
NEW EQUIPMENT
LATEST CATALOGS

## Heavy-Duty Relay

A heavy-duty relay with 10-amp rating is an optional feature of the Flo-Level L-400 series rotary-paddle, material-level controls.

Made by Flo-Tronics, Inc., Electronics Control Div., the transistorized L-400 is available in either weather-and-dust tight or explosion-proof enclosures.

This compact control unit is easily mounted on bin, hopper or tank walls at the desired control points by use of a $1^1/_4$-in. pipe coupling. The flexible sealed shaft extends into the interior; sensing paddle rotates continuously when not surrounded by material. Eleven inch-ounces of torque will stop the paddle. On the high-level model, paddle stoppage causes desired control or signal action. Paddle release effects control or signal action on the low-level model.

The control signal is generated by a novel circular magnet mounted on the motor shaft. An auxiliary winding on the shaded-pole induction motor provides power for the transistor amplifier circuit. All models have a unique fail-safe circuit which automatically prevents unsafe operation in the event of power failure or a component malfunction. —K-7

## Bearing Bronze

A rod material called "Bronze Case" in combination with hardened-steel bushings is an engineering concept for piston and guide rods and similar linear applications. Bronze bearing material is put on the large area of the shaft instead of being confined to the bearing area within a bushing. This provides substantial reductions in the cost of bushing and rod replacements and materially reduces downtime production losses. The cost of lubrication is reduced as well as the size and weight of many mechanisms. Using Bronze Case rods and hardened-steel bushings also increases operating efficiency and can frequently eliminate stick-slip and chatter. The new combination eliminates rust and nick problems. Bronze Case is now in production by Thomson Industries, Inc.

High-quality bearing bronze is fused on the surface of a steel rod which is subsequently ground and straightened to very close tolerances. The bronze fusing is done by a high-temperature spraying operation which forms a coating of controlled porosity for excellent lubricant retention. Lubricants wipe off. Additionally, the amount of lubricant stored is enormous since it is stored all over the relatively large shaft surface.

Bronze Case rods can be furnished promptly, with or without special machining, from a stock of standard material. Standard diameters are $^3/_4$, 1, $1^1/_4$, $1^1/_2$, $1^3/_4$, 2, $2^1/_2$ and 3 in. The diameter tolerance up to 2 in. is +0.0000–0.0005 in. For 2 in. and over, +0.0000–0.0007 in. Other diameters and tolerances can be furnished on special order. —K-8

# KEEP INFORMED

BUSINESS NOTES
NEW EQUIPMENT
LATEST CATALOGS

## Flexible Gear Coupling

Bulletin N-2 of the Flexible Coupling Div. of Sier-Bath Gear & Pump Co. describes the development of a reduced-dimension nylon-sleeve flexible gear coupling.

Called the "Mite" and designed to complement the size range of the standard Ny-flex coupling, it also has an all-nylon sleeve. However, the Mite sleeve weighs only $2^1/_2$ oz and has an OD of just $2^7/_8$-in. The total coupling, including the two zince die-cast hubs and two Spirolox retaining rings—five simple units—weighs 14 oz. The over-all length of the Mite is $2^3/_8$ in.

The Mite operates at speeds up to 5,000 rpm and will take up to ±3 deg misalignment. It requires no lubrication due to the nylon sleeve and special crown-hobbed hub teeth and can run in both the vertical and standard position.

The Mite is available in $^3/_8$-in. rough bore and eight finish-bore sizes ranging from 0.500 to 1.125 in. **—K–9**

## Pressure Adapter

Dumont Engineering Co. has developed a stainlesss-steel, leak-proof, oil servicing, pressure adapter with quick-disconnect cap assembly. When the cap assembly is removed, a nozzle connection can be attached to the adapter that will depress the poppet valve and permit oil flow under pressure. When the nozzle is removed by quick-disconnect, a spring returns the valve to its closed position immediately, shutting-off oil flow and preventing leakage. Pressure drop in the unit at a flow of 1 gpm with MIL-O-7808 synthetic engine oil at −45 F was only 14 psig for the $^1/_2$-in. tube size and 7 psig for the $^3/_4$-in. tube size. The unit conforms to the requirements of MS 24476 adapter, MS 24480 cap, and MIL-A-25676A. **—K–10**


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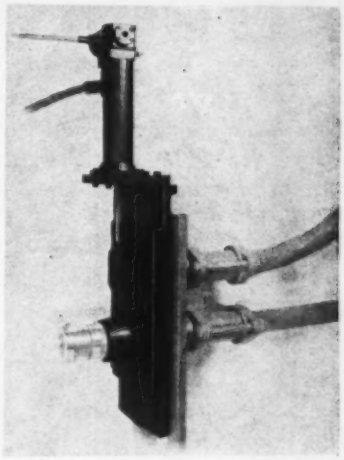
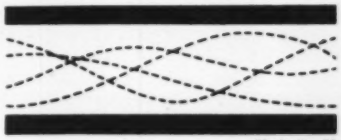
**NEW "FLO-SEAL" LINE DIVERTER**

Air operated, solenoid piloted "Flo-Seal" Line Diverter provides remote, automatic selection of two conveying lines. Surface-to-surface contact of the ground and polished slide on a stationary shoe insures maximum sealing area and provides air-tight operation. Ideal for "on stream" line switching—self cleaning operation with no areas for product accumulation. No seals or lubricants required. Dismantle for service or inspection in 60 seconds. Available in $1^1/_2$ inch through 10 inch conveying line sizes.

Flo-Tronics engineers are anxious to assist you with your air conveying problems. Write today for "Flo-Seal" Line Diverter product sheet and air conveying systems brochure. No obligation of course.





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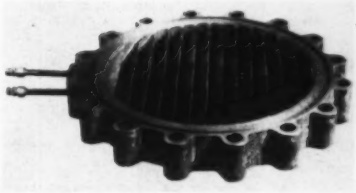

## Vacuum-System Baffles

A new series of optically-dense chevron-type baffles, to prevent back-streaming from the diffusion pumps in a vacuum system, has been developed by F. J. Stokes Corp. and is described in Data Sheet 567.

Stokes baffles are light in weight and corrosion resistant, being made of sturdy cast aluminum in a one-piece construction. For operation at moderate levels of vacuum, where a condensing surface cooled to 70 F is satisfactory, the Stokes baffles are designed to be water-cooled. For much higher vacuums, or more critical conditions, where the surfaces must be cooled down to temperatures of the order of −100 F, specially-built baffles may be obtained using either Freon or liquid nitrogen as the cooling medium.

These baffles are available from stock in 4, 6, 10, and 16-in. sizes (internal diameter of the passage). They are fabricated to mate with standard flanges; one face is grooved to accommodate an O-ring, the other face is machined to a satin-smooth flat face for mating with an O-ring. **—K–11**


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NO LUBRICATION
NO WEARING PARTS
NO BACKLASH

Write for Our New Engineering Catalog 60

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

Circle No. 125 on Readers' Service Card


# KEEP INFORMED

BUSINESS NOTES
NEW EQUIPMENT
LATEST CATALOGS

## Coding Process

Martin Co. manufacturing research engineers have developed a process for permanently marking Teflon insulated wires. The engineers, working in the company's Baltimore Electronics Div. sought a method for marking identification codes on Teflon which would withstand the environments, vibrations, temperatures and exotic fuels associated with missile and space systems.

Their solution is an automatic sintering process using a specially designed oven. The wire is identified with a Teflon foil marking, and the sintering causes a chemical fusion of the Teflon insulation and foil. Result is a permanent identification which cannot be removed without destroying the insulation.

The research model has been qualified by the Martin Co. for sintering Teflon insulated wires, gages 20 through 16, and a production model for sintering other sizes is nearly completed. —K-12

## Steam Trap

A thermostatic steam trap for pressures from vacuum to 150 psig and temperatures to 425 F has been developed by W. H. Nicholson and Co.

Known as the Nicholson N-150 and designed primarily for tracer lines, small pieces of steam processing equipment, and so on, the trap comes in $^1/_2$ and $^3/_4$-in. sizes and operates on a true-balanced pressure principle. Ideal for rugged service, it has a cast-steel body and forged-steel cover. The bellows is monel metal for high resistance to corrosion, and the hardened stainless-steel valve and seat are lapped together for tight, positive shut-off.

Uses include plating tanks, platen presses, sterilizers, laundry and dry-cleaning equipment, and as air vents for receivers, water heaters, and mechanical traps. —K-13

## Motor Bases

Three series of all-welded, tension-controlling motor bases with freely movable carriages have been introduced by Manheim Mfg. & Belting Co. These motor bases, to be known as Manheim Automatic, are said to eliminate excessive wear on belts and bearings by always providing, automatically, the proper amount of belt tension even under heavy starting loads.

The manufacturer points out that the proper amount of tension to apply to a belt drive is the minimum necessary to transmit the required power without slippage. This adjustment is achieved easily with a Manheim Automatic motor base. Readjustment, when necessary, is made while operating under load merely by turning a screw. Not a bolt or nut is disturbed and initial pulley alignment is always maintained.

In addition to assuring longer belt and bearing life, the company points out that maintenance is reduced and shock loads eliminated. —K-14


MECHANICAL ENGINEERS

ARC needs you for

DEVELOPMENT ENGINEER

For new Desomatic Division for development in fields of air treating and gas drying concerned with dehumidification. To work on existing projects & new project proposal preparation. B.S., M.S., mechanical engineering with experience in engineering calculations, structural design, sheet metal, welding, electrical power circuitry, and general light fabrication.

DESIGN ENGINEERS

To work in Rocket Design Section on design and development of high-performance rocket motor light-weight hardware. Design scope involves inert component design, knowledge of gas dynamics for solid propellant rocket nozzle design, pressure vessel construction, and metallic and non-metallic materials applications. B.S., M.S. in mechanical or aeronautical engineering with experience.

R & D APPLIED MECHANICS—STAFF ENGINEER

To work with Mechanical Engineering Division Director as applied mechanics specialist in fields of stress, heat transfer, and thermodynamics, on both practical problems and the organization of original R & D proposals. M.S. in mechanical engineering with good academic record.

ROCKET PROJECT ENGINEERS

To work on prototype development of solid propellant rocket propulsion systems. Involves coordination of programs with mechanical design, ballistic, instrumentation, and test engineers. Requires personable men with interests and demonstrated abilities to carry systems from inception through test and qualification. B.S. or M.S. in mechanical or chemical engineering with the ability to work effectively with others.

JR. SYSTEMS ENGINEER

Responsible for cost estimate and schedule preparation for both proposed R & D and manufacturing projects, as well as cost and schedule monitoring and maintenance of current programs. He must be capable of working closely with responsible advisory, and liaison personnel. B.S. in mechanical or industrial engineering, with experience in project engineering, cost estimating, and manufacturing liaison.

TECHNICAL REPRESENTATIVE

To represent the technical capabilities of the Space Vehicles Group in design, development, fabrication, and testing of rocket systems. Liaison with government agencies and missile contractors, as well as with Company engineers and scientists, including discussion of ARC capabilities with clients and proposal preparation. B.S., M.S. in engineering with experience in rocket systems preferred.

Atlantic Research Corporation is an expanding contract research and development company, located in the Washington, D. C. Metropolitan area. Its technical interests range from solid propellant rocket development and manufacture, through electronics and electromechanical instrumentation, to research and development of new and improved plastic materials.

*All positions require U. S. citizenship*

**If your qualifications and interests apply, send a resume of your academic and career background, age, salary requirements, and professional references to:**

**Clarence H. Weissenstein, Director**
**Technical Personnel Recruitment ME**

**Atlantic Research Corporation**
**Alexandria, Virginia**

## KEEP INFORMED

BUSINESS NOTES
NEW EQUIPMENT
LATEST CATALOGS

### Wall-Type File

Lewbill Industries, Inc., is now manufacturing, under licensed agreement, a new patented wall-type file for handling and storage of blueprints, drawings and other large sheet materials. Known as the Martin sheet file system, this unit allows the user to work with a large number of prints more neatly and efficiently because each sheet hangs flat, requiring less storage space and eliminating curl.

Construction is of a steel-tube frame hinged to a plywood mounting panel, with locking-hinge support arms. A unique feature of the Martin sheet file is the rubber-tipped lock clips used to mount sheets in the clamp hangers. Many prints can be clamped firmly in each hanger and may be removed easily at any time.

This new file is designed for architects, builders, designers, fabricators, and anywhere there is a problem involving efficient filing and protecting valuable sheet materials.

Martin units are available in two sizes: Model No. 30 will hold up to 30-in.-wide sheets; Model No. 42 will hold sheets up to 42 in. wide. **—K-15**

### Vertical Tank Heater

The Type KV-244 vertical tank heaters introduced by The Griscom-Russell Co. is compact and weighs only 1654 lb. It can be carried easily over the rough ground around a tank farm by only two men. The heaters will pass through a standard API 20 in. manhole and can be installed in new or existing tanks either singly or in banks.

These heaters consist of two lengths of 1-in. ips Scheule 40 steel pipe with G-R service proved helical aluminum K-fins spaced six to an inch. The helical aluminum fins of heavy-duty design, 5/8 in. high by 0.03 in. thick, are locked tightly into the pipe to assure good heat transfer; and since aluminum has a high coefficient of heat transfer, much higher than steel fins, the heaters have high heating capacity per foot of pipe length.

Two sections of the finned pipe are welded together to form one continuous length; and then wound into a helix of 13 turns only 19 1/2 in. in diam. The helix is supported on three steel channels that permit free thermal expansion, and position the heater well above sludge level in the tank.

The manufacturer reports that this one-weld construction eliminates the needless weight and additional welding associated with manifolds and headers, and avoids any need for stress relieving. Use of a single tube assures even distribution of steam and avoids cyclic stresses caused by any maldistribution of steam during startup. **—K-16**


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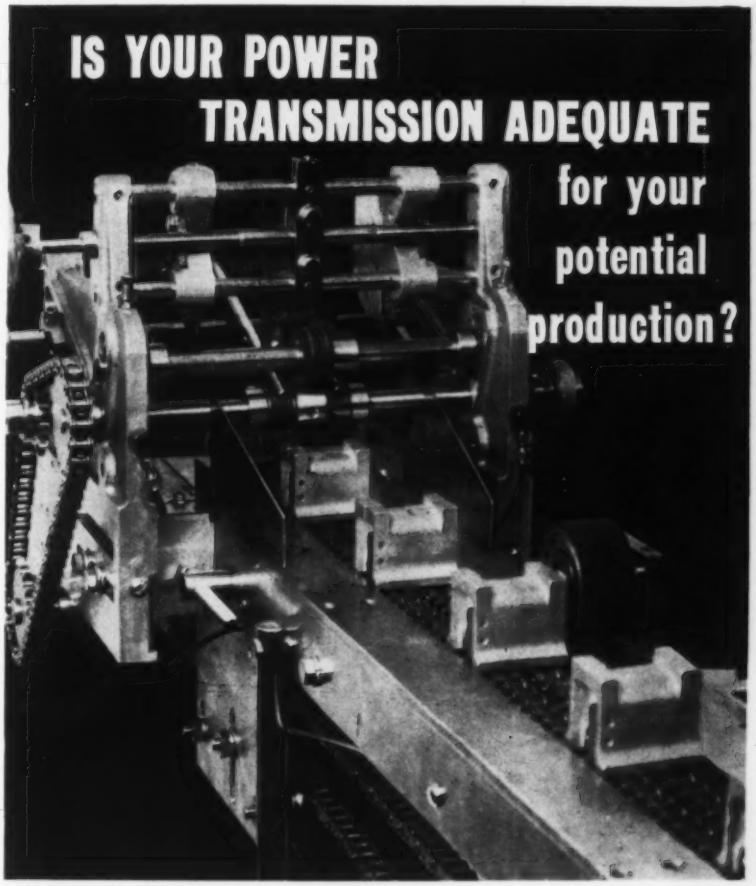


If you're not getting over 98% of the power furnished by the driving sprocket, you're increasing costly production and maintenance time. With Acme roller chain drives, there is practically no loss of ratio of energy between driving and driven members.

Acme chains are rigidly built of hardened steel, heat treated according to specific requirements of each part to assure long service with a minimum of maintenance, vital to maximum production.

Step up production by specifying Acme chains, available in all sizes from ¼" pitch to 2½" pitch.

***See your Industrial Distributor for off-the-shelf service on chains, sprockets, flexible couplings and attachments.***

Acme Chain Corporation
HOLYOKE MASSACHUSETTS

*Write Dept. N-11 for new ill. 100 page catalog with engineering section.*

**RELIABLE CHAIN DRIVES FOR ALL INDUSTRIES**

ROLLER CHAINS, SPROCKETS, CONVEYOR CHAINS, FLEXIBLE COUPLINGS, ATTACHMENTS. (Special and Standard)

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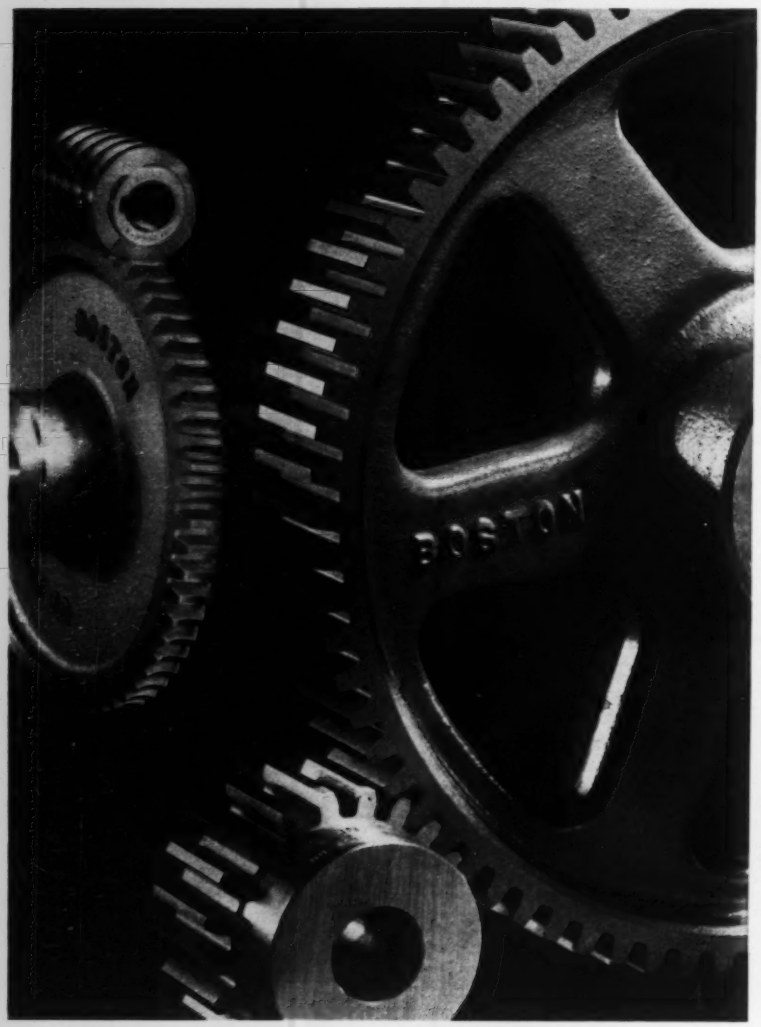
largest selection
14½° P.A. stock gears




**From local stock – at factory prices**
Spur, helical, worms and worm gears.
1781 types and sizes, from 48 to 3 pitch.
Brass, steel, iron, and non-metallic.
See Catalog 57 for complete listings.
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## BUSINESS NOTES

### H-P-M Div. of Koehring Co.

The Hydraulic Press Mfg. Co., acquired by Koehring Co. in 1956, has changed its name to H-P-M- Div., Koehring Co. Previously, this Mt. Gilead, Ohio, manufacturer of plastic molding, die casting, and metal-working machines, was known as the Hydraulic Press Mfg. Co., Div. of Koehring Co.

There will be no change in sales, administrative, or manufacturing functions. These will continue to be located at the firm's plant in Mt. Gilead.

### Smith Welding–Name Change

The board of directors of Smith Welding Equipment Corp., Minneapolis, Minn., has announced a new corporate name, the opening of a new division, and a change in officers. The name change to Tescom Corp. is described as in keeping with the expansion and diversification acts of the company.

The board also announced the activation of a new Fluid Systems Div. For the past two years, expanded facilities have been used to design, test and manufacture pneumatics regulation equipment for the control of pressures up to 10,000 psi. Products of the division, known as "Flo-tron" regulators, have already been sold for use by the military and in the missile, chemical, and petroleum industries.

Smith Welding Equipment will become a division of Tescom Corp., and manufacturing operations for both divisions will continue at the Minneapolis plant location. Ownership of the company is unchanged.

## LATEST CATALOGS

### Lubricant

"Electrolube," a new air-dry, solid-film lubricant priced and produced for commercial applications, has been developed and field tested by Electrofilm, Inc., and is described in a recent brochure. This one-coat, air-dry lubricant can be applied by spraying, dipping, or spray-tumble. This new coating combines corrosion resistance and lubrication in one step eliminating the need of other corrosion-resistant coatings such as paint, electroplate, and so on. Parts coated with Electrolube have withstood 100-hr salt-spray tests with no visible traces of corrosion. Priced for conveyer and production line applications, Electrolube is available in 50-gal drums or 5-gal cans. In production tests, 339 lb of die-cast aluminum parts at 45 pieces per lb will use only 1 gal of Electrolube concentrate. This new coating is only 0.0002 to 0.0005 in. thick with a coefficient of friction as low as 0.025 under high loads. —K-17

## KEEP INFORMED

BUSINESS NOTES
NEW EQUIPMENT
LATEST CATALOGS

### Lubricated Plug Valves

A 12-page bulletin is the result of much data gathering by Walworth Co. By supplying accurate pressure-drop data on existing valves, systems designers may now, through the bulletin, select the most efficient and economical valves for their particular piping needs.

The bulletin lists 85 Walworth lubricated plug valve figure numbers from which the engineer may select data and calculate pressure drop with either the K-values or equivalent feet method.

The computations covered in the bulletin will fulfill most piping requirements. Where unusual flow conditions exist, Walworth engineers will still provide pressure drop information. **—K–18**

### Pneumatic Transmitter

Pneumatic transmission of flow, normally used in conjunction with such differential producers as Venturi tubes, Dall flow tubes, Venturi nozzles or orifice plates is described in a specification data sheet featuring the Model 281-01 transmitter, by B-I-F Industries, manufacturer of equipment and systems for positive control of materials flow.

Rated as one of the most accuracte instruments in the pneumatic classification, the simple functional design of the Model 281-01 transmitter receives differential pressures on surfaces of mercury in two wells. A cam and pneumatic transmitter mechanism transform these pressures to an output pressure proportional to the main line flow.

The four-page specification data contains illustrations, basic descriptions and specifications. Schematic drawings show dimensions and a typical installation of the Model 281-01. **—K–19**

### Hydraulic Press Operation

Bulletin 5500 of the H-P-M Div. of Koehring Co. describes the H-P-M closed-circuit "Fastraverse" system which is a modern method of hydraulic press operation for production service. It has been thoroughly established through many important industrial applications.

The closed-circuit system provides regulation of both speed and direction of every press ram movement through control of the output of the pressure-generating pump. There is no reversing valve. The pump flow is both variable and reversible, going through zero at each press reversal. Thus H-P-M press action is fast, yet smooth and shockless. Peak press production results; idle time and maintenance are at a minimum. **—K–20**

FOR CONSULTING ENGINEERS TURN TO PAGE 166


BOSTON Gear® QUALITY

largest selection
20° P.A. stock gears

**Off-the-shelf delivery – from stock**
at over 100 Distributors. Spur, bevel, miter.
782 types and sizes. 120 to 4 pitch.
Brass, steel, iron, and non-metallic.
Design around gears you can get today.
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# KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

### Snap Switches

Columbus Electric Mfg. Co. is distributing loose-leaf data sheets describing combination controls, snap switch principles, standard and miniature snap switches, and rotary switches. Diagrams, illustrations and tables are included for general information. —K-21

### Coated Strip Steels

Sharon Steel Corp. shows its line of galvanite, "brite" zinc, special alloy coat, electro-galvanized, and painted and printed coated strip steels in a 12-page booklet.

Typical applications, tables and illustrations accompany each type described. —K-22


## NEW OPENING

### Offering Unusual Career Potential

## PUMP DESIGN ENGINEER

### . . . over $10,000 salary bracket

One of the nation's leading manufacturers of products for the industrial, consumer and defense markets has a recently created position for an experienced centrifugal Pump Design Engineer. This position offers outstanding personal as well as professional potential with a company not now engaged in the manufacture of pumps, but of advanced systems in which pumps—(10 to 1500 hydraulic h.p. range)—are incorporated.

**RESPONSIBILITIES**

**You will assume full technical responsibility for pump design and development, and for providing pump application data on these designs. You will also provide consulting services to engineers designing the systems in which your pumps will be used.**

**QUALIFICATIONS**

**BSME together with an MS (or the equivalent in experience). Minimum experience requirements include 5 to 10 years with a pump manufacturer—preferably in fluid mechanics and/or centrifugal pump design. You must also be able to meet and favorably impress our customers.**

Location is in the Northeast. You will have full access to computers, extensive testing facilities, consultants and laboratories.

Qualified applicants will be invited to visit our facilities at Company expense. Relocation assistance will be provided. Additional information about our extensive benefits program for employees and dependents will be provided.

Please include enough information about your education and experience to justify further consideration for a position of this salary and responsibility level. All qualified applicants will be considered for employment without regard to race, creed, color or national origin. SJ-549A

**FOR MORE INFORMATION, write in confidence to:**

**BOX CA-7186,**
**care of "Mechanical Engineering."**


### Conveying Line Diverter

An illustrated, specification sheet describing the "Flo-Seal" line diverter is available from Flo-Tronics, Inc., Air Conveying Div. The diverter is said to increase the efficiency and reduce the cost of diverting a conveying stream of powdered and granular material. It allows fast, efficient selection of two conveying lines. The Flo-Seal is described as designed to meet the strict sanitary codes of the food industry.

Complete physical and operating specifications are detailed in the literature. The unit is self-cleaning, requires no lubricants, and is easily dismantled for inspection or servicing. Several units may be arranged in a series to add to the number of locations which may be served by a single conveying system. —K-23

### Dust Separator

The HV centrifugal dust separator is detailed in Bulletin E-221 released by the Day Co. This 12-page illustrated brochure includes performance data, selection and dimension charts, and installation photographs with descriptions for the HV cyclonic separator and HV supports.

The HV is a rugged high-efficiency unit which comes in 20 standard sizes and can handle any volume of air from 150 cfm up efficiently and economically. Mutiple groupings of the HV can be furnished "tailored" to meet any collection requirements. Because of rugged construction, smooth interior and high separating efficiency, the HV can be used for a wide range of applications. It successfully handles fibrous, granular, abrasive and fine or coarse dusts and can be used on pressure or vacuum. —K-24

### Electro-Mechanical Devices

Autotronics Inc. handbook of miniature electromechanical devices is designed to assist the engineer in selection and application of electro-mechanical clutches, torque indicators, torque standards, and multispeed transmissions. Information on custom designed units and how they are used is also given in the handbook.

The handbook includes: Sixteen pages of engineering and application information; two pages describing Autotronics facilities for manufacture; a torque conversion chart; specifications, dimensional data, schematic, performance-curve method of operation and ordering code is given on 354 standard clutch/brake units; and two pages of general characteristics with illustrations and instructions on inspection and response time measurement, giving a total of 60 pages of design specifications and design assistance. —K-25

# KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

## Quick-Connect Couplings

Bulletins 240-61 and 250-61 containing complete specifications and details on quick connect/disconnect couplings have been issued by Snap-Tite, Inc. The brochure also include a complete catalog of spare parts, accessories, and suggested methods of using the couplings.

Designed for distribution to the process and project engineer, the booklets cover Snap-Tite's line of E and H couplings. Although many other styles are available, these two models are the most popular, according to Snap-Tite.

The E design is used in high-pressure, gravity flow, and vacuum systems, while the H model is used primarily in hydraulic lines. —K-26

## Drafting Furniture

Hamiltion Mfg. Co., in a four-page brochure, illustrates the Stratacore drawing board's mechanism and table base versatility.

Exclusive features of Hamilton drafting furniture design, engineering and construction include: Complete counterbalanced adjustment range, completely counterbalanced drawing board angle and height adjustment, complete reference desk flexibility, Stratacore drawing board, aluminum pencil trough, optional 50 in. reference surface and auxiliary tool and catalog drawer unit.

Specifications and dimensions of top and over-all floor space and drawer dimensions are also included. —K-27

## Digital Process Controllers

Bulletin 201 of Dynapar Corp. electronic subsidiary of the Louis Allis Co., has announced a complete line of transistorized digital process controllers for industrial counting, measuring, and control applications.

Digital process controllers accurately count pulses from all types of sensing devices to indicate and control various functions of other equipment when a preset count is reached. They meet high-speed, high-accuracy requirements with no mechanical parts to wear out, since transistorized circuitry provides millions of operations without wear.

Ruggedly designed for industrial service and dependable operation, they are furnished in attractive cabinets, styled with recessed panel to protect tubes and controls and feature plug-in components that are easily serviced from the front.

Standard and Special Controllers are available to meet the requirements of specific applications such as automatic cutting-to-length lines, footage and fault measurement on wire and cable lines, footage measurement and control for paper converting processes and complete digital program controls for highly automated production lines. —K-28

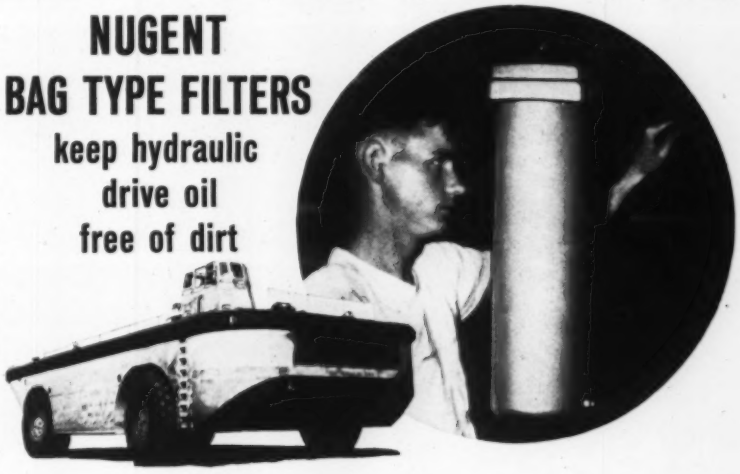
## Switches

ACRO Div. of Robertshaw-Fulton Controls Co. describes its line of switches in a recent brochure. Switches illustrated include: ACRO-Lite machine tool, metal clad, general purpose, open blade, relays appliance, sub-miniature, and miniature. —K-29

## Clutch Conversion

Minster Machine Co. in Bulletin CC57 describes and illustrates methods of increasing production and reducing maintenance through clutch conversion in presses if the present clutch is obsolete and slow, or if it is trouble-ome and costly to maintain. —K-30


NUGENT
BAG TYPE FILTERS
keep hydraulic drive oil free of dirt



Into the water, out of the water, on smooth roads, across rough fields and through desert sands the Amphibian BARC is propelled by Allison Hydraulic Drive for each wheel. Nugent bag type filters keep the oil in the hydraulic transmission clean for each wheel and provide instant response to meet various driving conditions.

The filtering medium is a close, evenly woven, lintless, acid-resisting, textile bag, which is wound around a flexible wire screen to provide a large filtering area and prevent collapsing. Dirty solids, as small as 10 microns, abrasives, carbon, etc., are retained. Bags are a throw-way type but can be washed and reused easily.

If your equipment demands the ultimate in efficient filtering protection, now is the time to investigate the advantages Nugent offers you. Write for complete information today.

161

ESTABLISHED 1897
REPRESENTATIVES IN PRINCIPAL CITIES

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3412 CLEVELAND STREET, SKOKIE, ILLINOIS
OIL FILTERS • STRAINERS • TELESCOPIC OILERS
OILING AND FILTERING SYSTEMS • OILING DEVICES
SIGHT FEED VALVES • FLOW INDICATORS

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# KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

## Quick-Connect Couplings

The Hansen Mfg. Co. describes its line of quick-connective couplings in Catalog 100.

These one-way and two-way couplings are produced in a wide range of sizes and types from which exactly the right coupling for particular requirements may be selected.

The careful design of Hansen couplings, embracing specific features for various types of service, is the result of years of experience with fluid-line layouts in many plants. —K-31

## Hydraulic Fittings

A data sheet of AFCO Fitting Co., Div. of U. S. Air Cmpressor Co. shows the UF flareless tube industrial hydraulic fitting. Completely reversible ferrule makes incorrect assembly impossible.

This versatile new fitting is suitable for use on steel, stainless steel, copper, aluminum, and most plastic tubing with a minimum reduction in the inside diameter of the tube.

All AFCO fittings are machined from forging and bar stock. They conform to performance requirements of JIC, ASME, SAE, and MIL-F 5506-A. —K-32

## Gauge Protectors, Shock Dampers

Flow Restrictors and Snubbers now available in various configurations, used as gauge protectors against surges, as shock dampers in lines and systems, stocked for short delivery in standard sizes $^1/_8$ to $^1/_2$ inch and porosities of 2 to 65 microns, are described in data sheets of Remm Co. —K-33

## Flexible Couplings

Bulletins 82 and 160 of Thomas Flexible Coupling Co. show various applications of its all-metal flexible couplings.

Thomas flexible couplings (Bulletin 82) are used for mining, cement, and other heavy industries with proven reliability on heavy-duty drives (such as those pictured in the bulletin) as well as on pumps for dewatering mines, supplying water for process, and so on. They can also be used for blowers for mine aeration and exhaust, generator sets and power transmission drives of all kinds.

Bulletin 160 shows typical applications in the paper industry. —K-34

## Corrosion-Resistant Materials

U. S. Stoneware Co. in Bulletin T-3 gives a brief description of some corrosion-resistant materials and process equipment. More detailed information is contained in additional brochures also available.

The general topics include: Fabricated towers and custom tower construction, tower packing materials, "Tygon" flexible plastic tubing, protective coatings, gasketing, tank linings, grinding and mixing equipment, and chemical ceramics. —K-35

## Roller Chain

Acme Chain Corp. illustrated roller chain and sprocket catalog contains 106 pages of power-transmission plans and ideas. It contains useful information for engineers, designers and others who use power-transmission drives. The engineering section contains 35 methods of chain adjustments on movable-sprocket center drives and fixed-sprocket center drives, plus all necessary data and prices on Acme's complete line of roller chains, sprockets, standard and made-to-order conveyer attachments. —K-36


SPLIT-EYELET CONNECTORS

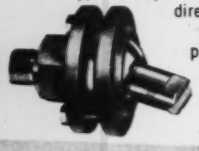
For faster, easier connection of spray nozzles, branch lines and equipment to piping and tubing carrying liquids, gases or air up to 250 psi. Write for Bulletin 93.

FOR BETTER PERFORMANCE

SPRAY NOZZLE ACCESSORIES

ADJUSTABLE JOINTS

For easy, exact adjustment of spray direction. Made in size for ¼" to 2½" pipe in brass, steel and stainless steel. Write for Bulletin 97.



...EASIER INSTALLATION

LINE STRAINERS

Special non-collapsing screen design for pressures up to 125 psi, for all pipe lines from ¼" to 6" size. Also high pressure strainers for up to 5,000 psi service. Write for Bulletin 94.

FOR COMPLETE SPRAY NOZZLE INFORMATION WRITE FOR CATALOG 24

SPRAYING SYSTEMS CO.
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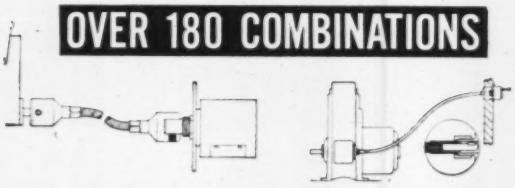
SAVE TIME SAVE MONEY

OVER 180 COMBINATIONS



Heretofore a flexible shaft was designed as a special unit requiring costly, time-consuming engineering.

CIRCLE ESS STANDARD FLEXIBLE SHAFT ASSEMBLIES are versatile enough to fill the demands of many different applications and yet offer the advantages of economy in time and money.

They are composed of stock components, the finest steel cable, vinyl covered steel casing and cadmium plated coupling type steel end fittings.

Send for our new bulletin. Learn about this new economical way of buying flexible shafts.

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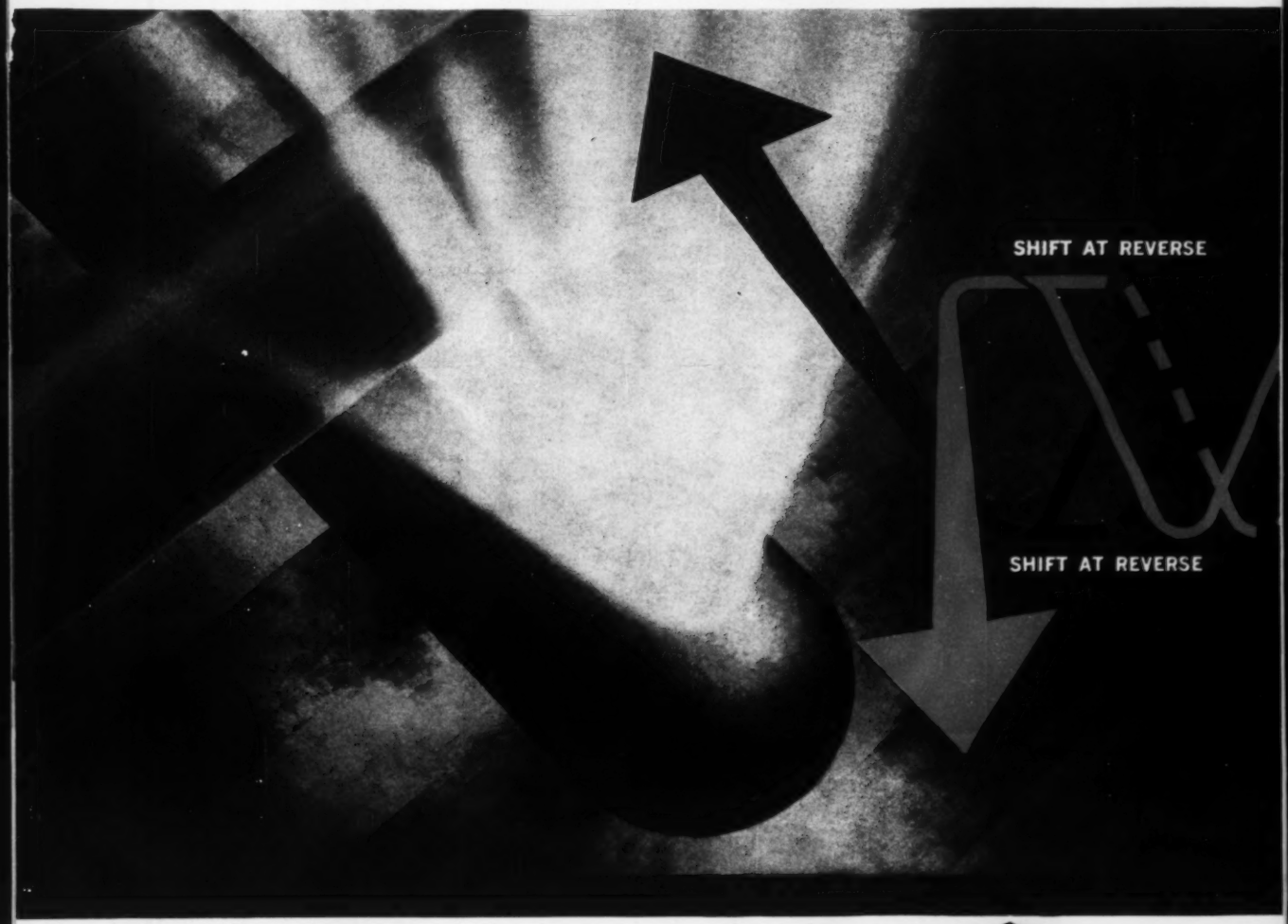
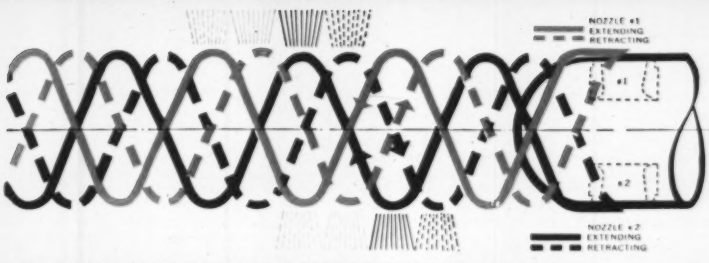
Diamond developed for more economical power...

# A CLEAN SWEEP...EVERY INCH OF THE WAY

**Get uniform, complete cleaning** in those "tough-to-clean" zones. Specify Diamond's IK-300 Retractable Blower. The exclusive close-spaced IK helix assures a penetrating nozzle sweep every inch of travel regardless of tube bank arrangement and tube spacing. What's more, because sectionalized lance tube construction cuts deflection to a minimum, smaller boiler cavities are possible. In addition, a unique method of equalizing nozzle end-thrust assures "minimum-wobble" travel regardless of distance.

IK's are just part of the reason behind Diamond's established superiority in boiler cleaning systems. Add a complete line of cleaning equipment, an experienced, imaginative engineering staff and an unmatched service organization. No wonder thousands of utility and industrial power plants are equipped with Diamond Cleaning Systems — engineered and designed to provide you with more economical power.




Diamond

DIAMOND POWER SPECIALTY CORPORATION, Lancaster, Ohio • Diamond Specialty Limited, Windsor, Ontario

Circle No. 44 on Readers' Service Card

# Here's a vertical turbine with

# TERRY SOLID WHEEL

## and all its advantages

When it comes to judging a turbine's ability to deliver in vertical service, ratings tell only half the story. It's the Terry construction refinements that give you assurance of long-range operational economy: Thrust bearing designed to absorb external pump thrusts ... carbon ring glands specially made for vertical operation ... casings and bearing housings split vertically for easy accessibility.

But most important, the Terry vertical turbine has an *almost* indestructible rotor. A single forging of special composition steel, it has no separate parts to loosen or work out. As the only function of the blades is to form a series of pockets, any wear which might occur would not materially affect horsepower or efficiency.

If your application demands a vertical turbine, specify Terry solid wheel. Available in capacities from 5 to 300 horsepower. And remember, the extra durability built into these vertical turbines is typical of every turbine in the complete Terry line.

*For further information, send for a copy of bulletin S-137.*

**THE TERRY STEAM TURBINE CO.**
TERRY SQUARE, HARTFORD 1, CONN.

TERRY

TT-1210

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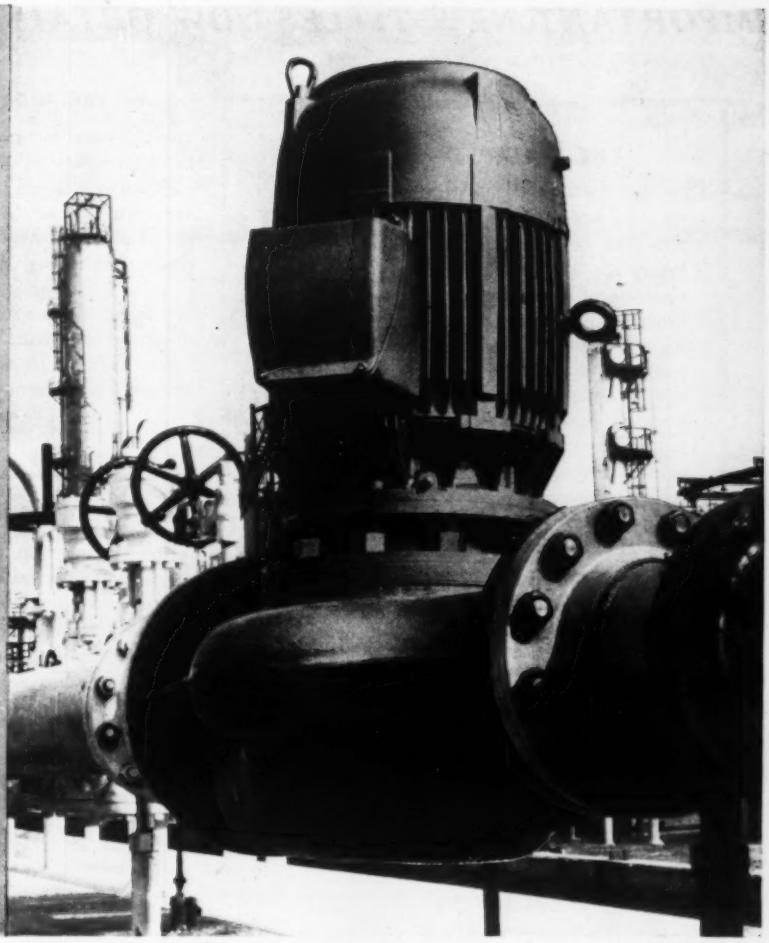
Designed for best Economic Balance

NEW

# PACIFIC TYPE SPM

## Pipe-Mounted Transfer and Process Pumps



*ECONOMIC BALANCE*—an optimum relationship between capital and continuing costs of equipment is especially true in process pumps, whose lifetime operating and maintenance costs may be many times the initial investment.

Here are the factors of best economic balance in process pumping offered by Pacific's new pipe-mounted centrifugal pumps:

**LOWER FIRST COST:** Fewer (only six functional) parts · No separate pump bearings or brackets · High degree of interchangeability—minimum inventory.

**LOWER INSTALLATION COST:** No baseplate or foundation required · No field alignment necessary · Integral drive—no motor coupling · Flange-mount and connect to power—that's all.

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**LOWER OPERATING COST:** Each pump impeller designed for peak efficiency in a given application, *or* · Where low power costs permit, orifice control can be provided to adapt one pump size to a wide variety of applications.

There is only one *true* cost of a process pump. It's the *overall*, lifetime cost of the unit. Make a date with your Pacific Pump representative to discuss the entire pump standardization plan in your plant. He has the broadest line of any in the process field . . . and the experience to match.

*Write for New Type SPM Bulletin 142*

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CENTRIFUGAL PUMPS FOR PETROLEUM, CHEMICAL, UTILITY & GENERAL INDUSTRIES
OIL WELL PUMPS

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*Inc. . . A Division of Dresser Industries, Inc.*

**HUNTINGTON PARK, CALIFORNIA, U.S.A.**

CP-25

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# *IMPORTANT NEW TITLES NOW OBTAINABLE FROM ASME*

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## THE THEORY OF ELASTIC THIN SHELLS

Here is a monograph that presents with sufficient rigor the mathematical foundations of shell theory and discusses in detail the approximate methods of solution. Although originally published in the Russian language in 1953, it is today the only book that formulates as completely as possible the different sets of basic equations and various approximate methods of shell analysis emphasizing asymptotic integration. This English edition has been brought up to date by including a considerable number of additional and recent references, and a supplement which embodies the most recent advances of the method of asymptotic integration. The presentation is arranged in such a manner that each part of the book represents a complete entity.

**Partial contents:** In Part I the general formulation and equations of the theory of shells are deduced which are based on the well-known hypothesis of the preservation of the normal element, and a brief survey of certain notions of the theory of shells presented. Part II is devoted to the membrane theory. Part III considers methods of analysis of circular, cylindrical shells with the aid of trigonometric series. Part IV is essentially mathematical in character and its purpose is to justify the approximate methods of shell analysis. In Part V approximate methods of analysis of shells are formulated which are based upon the results obtained earlier.

**To be published September 1st.** **$15.00**

## WATER HAMMER IN HYDRAULICS AND WAVE SURGES IN ELECTRICITY

In 1950 the numerous water hammer articles dealing with the "Graphical Method" as developed by the late Professor Bergeron, were collected and published in French. Under the sponsorship of the ASME and through the efforts of many of the authorities in the field, a complete and accurate English translation of the book is now available. Professor Bergeron's approach to the solution of complex surge problems is practical as well as theoretically sound. His simple, straight-forward explanation of the subject is readily understood by all and requires no extensive knowledge of higher mathematics. In addition to articles on water hammer the book includes extensions of the "Graphical Method" to the analysis of transient phenomena on electric power transmission lines, to vibration and shocks in mechanical systems, and other phases of mechanics. **$15.00**

## TEMPERATURE MEASUREMENT

This book is a revision, an expansion, and a consolidation of the information on temperature measurement instruments published separately during 1931–1945 in the Instrument and Apparatus supplements to ASME Power Test Codes. In the 118 pages of this new supplement are specific directions and precautions in the use of instruments, detailed information to guide the users in the calibration of instruments, and a discussion of the apparatus required and the methods to be used. Types of instruments covered are: Radiation thermometers, thermocouple thermometers, resistance thermometers, liquid-in-glass thermometers, filled system thermometers, optical pyrometers, and bimetallic thermometers.

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## MEASUREMENT OF SHAFT HORSEPOWER

A new addition to the Instruments and Apparatus supplements to the ASME Power Test Codes. Its purpose is to show how measurement of shaft horsepower of rotating machines can be accomplished either by the direct method which utilizes dynamometers, or the indirect method which uses calibrated motors or generators, heat balances or heat exchanger. Appendexes give the speed and the horsepower range of seven direct methods and show how dynamometer corrections are determined. **PTC 19.7—1961** **$2.50**

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This Instrument and Apparatus supplement on rotational speed measurements describes the instruments and methods commonly used for rotary speed or slip, and gives information regarding the characteristics and limitations of commercially available instruments ordinarily employed with the testing of any rotating machinery, turbine, blower, or electric motor.

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## FLOW VISUALIZATION

Many different techniques for making fluid flow phenomena visible to the human eye are described in this book. The summary presentations in its pages were made at the 1960 Winter Annual ASME Meeting.

**Contents:** Importance and Use of Flow Visualization Methods. Flow Visualization in Two and Three Dimensional Flow Fields By Use of Smoke Filiments. The Injection of Dye for Flow Visualization. Neutral Density Beads for Flow Visualization. Flow Visualization Using Tufts in Turbomachinery. The Use of Wall Trace Techniques to Indicate Flow Pattern. The Electrochemical Technique of Flow Visualization. Spark Discharge Methods for Indicating Flow Profiles. Streaming Birefringence as a Qualitative and Quantitative Flow Visualization Tool. Extensions and Limitations of Schlieren and Shadowgraph Methods. The Use of Schlieren Methods to Observe Moving Waves in Reactive Gases. The Application of Interferometry to Time-Varying Flow Conditions. Techniques of Flow Visualization Applicable in Low Density Fields. Specialized Applications of Electronic Flash in High-Speed Photography. The Observation of Unsteady Flow in Liquid Propellant Rocket Engines. Photographic Methods of Observing Cavitation. **1960** **$3.00**

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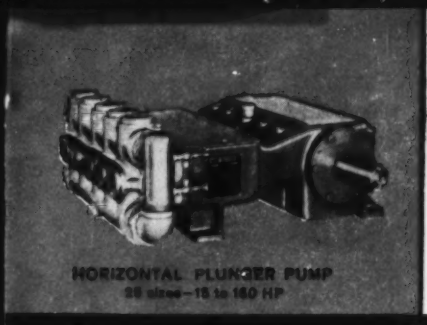
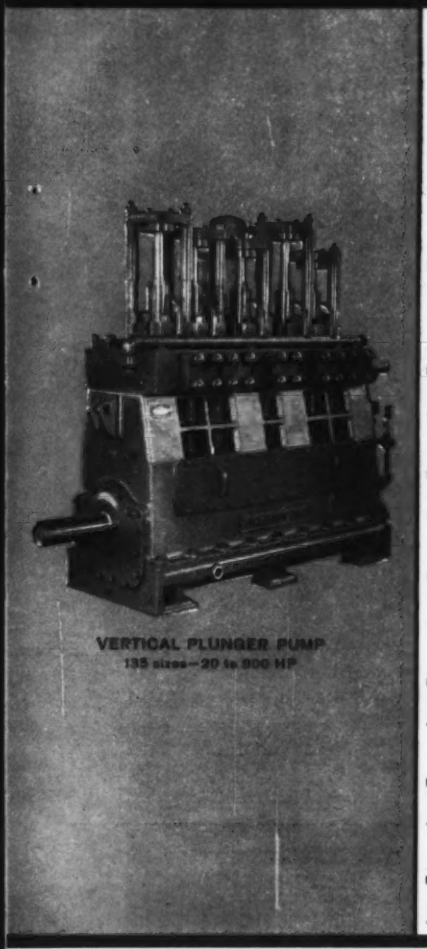


HORIZONTAL PLUNGER PUMP
25 sizes—15 to 150 HP



VERTICAL PLUNGER PUMP
135 sizes—20 to 900 HP

Choose a Worthington plunger pump . . .

# ODDS FAVOR YOU—160:1

Yes, you can choose from 160 standard sizes in the basic Worthington plunger pump line—25 horizontals, 135 verticals. You get 160 chances to be right from our basic pump models. But that isn't all.

In both lines, speeds can be varied, still other plunger and cylinder sizes are available. So each type can be tailored to deliver a very exact performance.

Remember, you choose from two basic types—horizontal or vertical. Each has its basic benefit. The horizontal power pumps have extremely low first cost; the vertical power pumps are designed for extremely rugged, long-life service.

Both vertical and horizontal Worthington power pumps are engineered to give the most reliable possible performance for their type. Stainless steel valves and Colmonoy plungers are typical long-life features.

You'll find both Worthington power pump types are designed for easy maintenance. There is fast access to valves through individual valve covers—piping remains undisturbed. Each cylinder size will accept a choice of plunger diameters to suit service conditions, and other parts are interchangeable between similar models.

Yes, because of the breadth and flexibility of the line, Worthington power pumps can be matched quickly to any power pump installation.

For information, write Worthington Corporation, Dept. 32-12, Harrison, New Jersey. In Canada, Worthington (Canada) Ltd., Brantford, Ontario.

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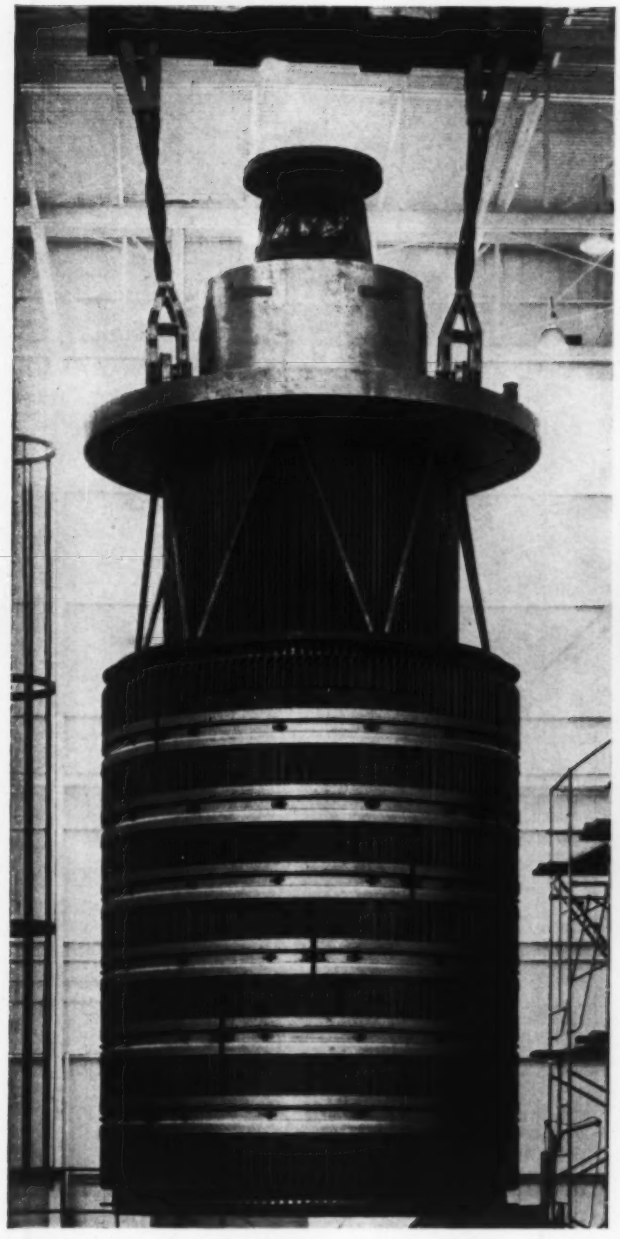
# TOMORROW'S POWER



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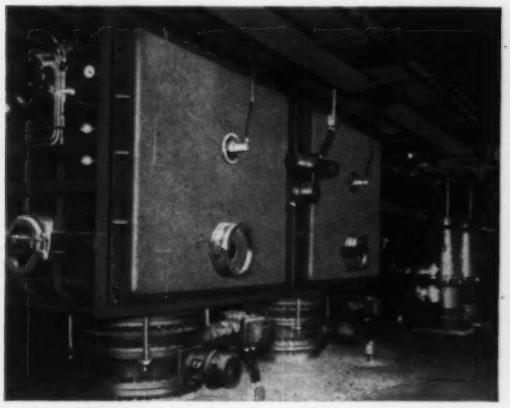
**C. H. WHEELER / GRISCOM-RUSSELL**

**COMBINED INGENUITY**

**AND SKILL BUILT IT.**

Three identical Griscom-Russell Vertical Once-Through Involute Tube, Liquid Sodium Heated Steam Generators (one of which is shown here)—have been installed and are being tested at the Enrico Fermi Power Plant built by the Power Reactor Development Corporation. These generators—first of their kind ever built—are an important break-through in the continuing efforts to produce steam from nuclear power more economically.



This 50,000 sq. ft. C. H. Wheeler Condenser at the new Indian River Plant of the Orlando (Florida) Utilities Commission, serves the 78,500 (rated capacity) turbine-generator. Its special deaerating features saved money in installation costs. C. H. Wheeler Ejectors, Circulators and the Condensate Pumps shown at the right also serve this new plant.

**GRISCOM-RUSSELL** / **C. H. WHEELER**

Massillon, Ohio — Philadelphia 32, Pa.

From this combined source you may now select condensers, circulating, condensate and general service pumps, steam jet ejectors, feedwater heaters, evaporators, generator gas coolers, tank heaters, heat exchangers, or special steam generators . . . all engineered and coordinated to meet the performance and space requirements of your power station.

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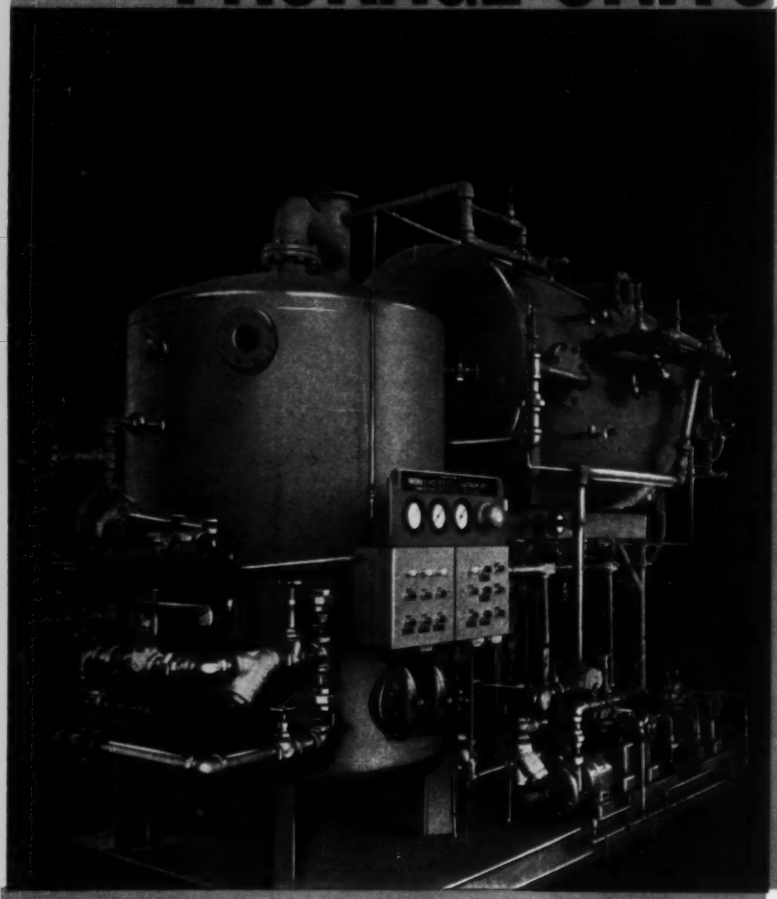
# BOILER AUXILIARY PACKAGE UNITS

*standard*



**Save On First Cost • Engineering • Building Space • Construction Time • Operating and Maintenance Cost**

Wickes Boiler Co. now offers a packaged system of various compact combinations of DEAERATING FEED WATER HEATERS, BOILER FEED PUMPS, CONDENSATE SURGE TANKS and BLOW-OFF TANKS. Standard units available for steam plants of 10,000 to 100,000 lbs. of steam per hour capacity and steam pressure to 300 PSIG. Information on special units of higher capacities and pressures upon request. Each unit is shop-assembled on a structural steel base, completely piped and wired and equipped with all necessary controls and an instrument panel.

173

Write today for Bulletin 59-1, which gives detailed engineering information on all three models of Wickes Boiler Auxiliary Package Units.

**WICKES BOILER CO., SAGINAW 13, MICHIGAN**
*Division of The Wickes Corporation*

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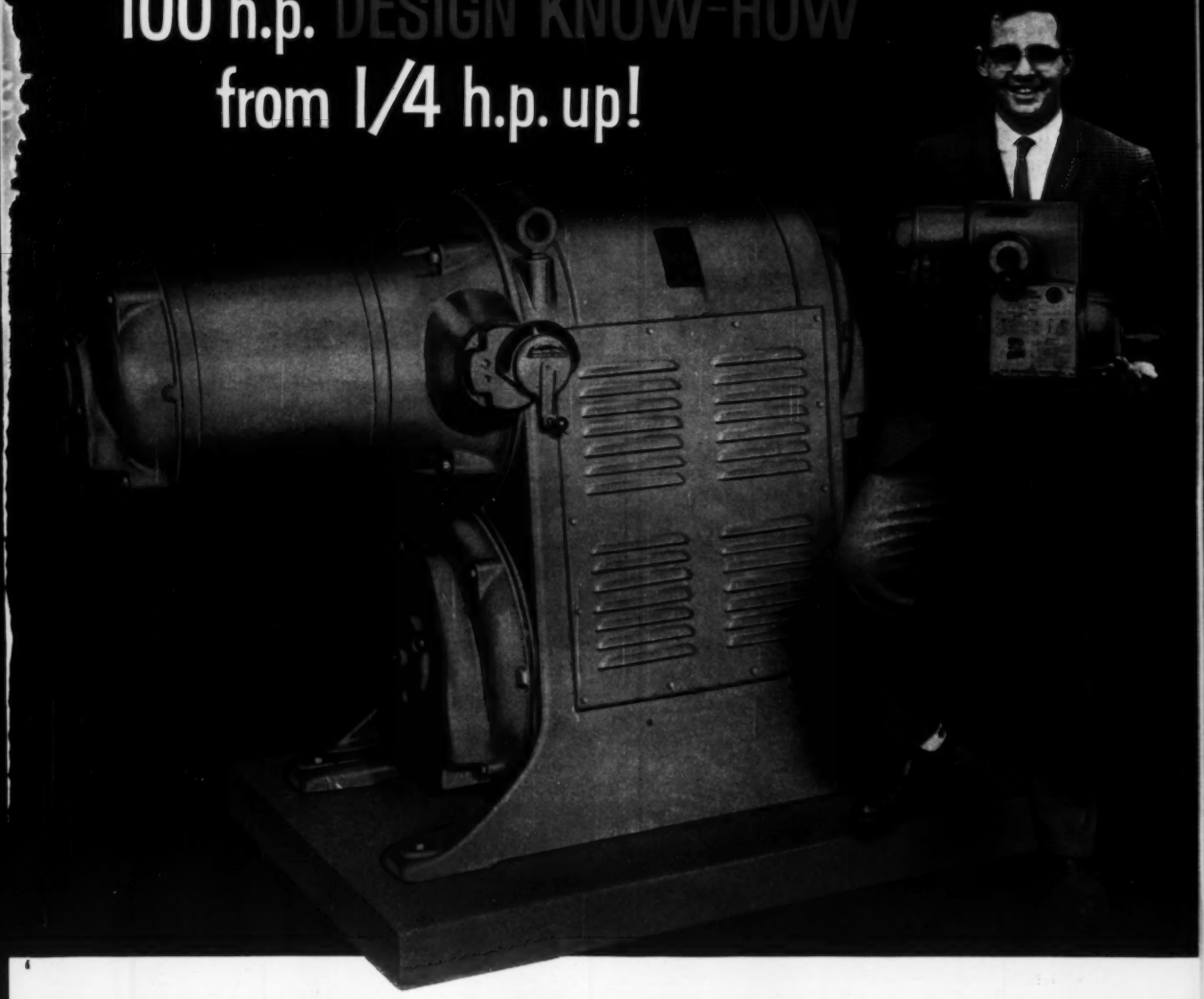

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**IT'S A FACT:**

On air or water lines, even the slightest 1/64" leakage will cost $50 to $60 per year. The cost of the average 1" valve can double in just 2 months if it isn't absolutely leak-proof!

*Every time you replace a leaking valve with a DeZurik Eccentric-Action valve you SAVE MORE than the cost of the valve!*

DeZurik Valves don't leak because their eccentric-action assures the most positive closure every time. In an easy quarter-turn, with never a bind or score, DeZurik's resilient-faced eccentric plug and matching seat deliver a cushioned, self-adjusting shut-off that's 100% leak-free even with solids in the flow. No clogging, no lubrication. That's why DeZurik Valves can actually cost you nothing and make money for you by eliminating losses and maintenance. CATALOG ON REQUEST.

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**that are safe, reliable . . . and *effective***

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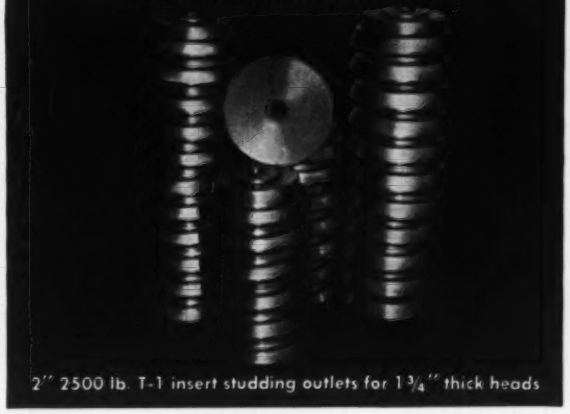

2" 2500 lb. T-1 insert studding outlets for 1¾" thick heads

By concentrating on pressure vessel construction problems, Lenape can offer the widest range of studding connections for pressure vessels of all types. Their attractive low silhouette design provides easy access to the vessel. Simply attached, their reduced welding costs are a boon to pressure vessel fabricators and users everywhere.

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Red Man Products

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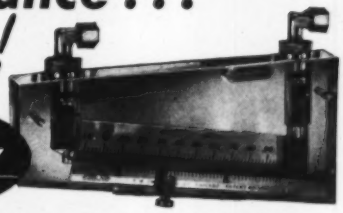
Dwyer



## AIR FILTER GAGE

With the Dwyer Air Filter Gage you can be sure of maximum filter efficiency because you know the *exact* time to replace filters, *every time*. Gives a continuous, accurate check that spots inefficient filters, yet prevents waste through premature replacement.

The Dwyer measures filter efficiency the only practical and economical way—via pressure drop. Quickly pays for itself through savings in replacement and service time and greater operating efficiency.

Break-proof plastic construction, lifelong accuracy, simple installation, no moving parts to ever wear out or get out of adjustment. Ranges 0-½", 0-1", 0-2" and 0-3" water. A complete unit with all necessary tubing, fittings, etc.

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**F. W. DWYER MFG. CO.**

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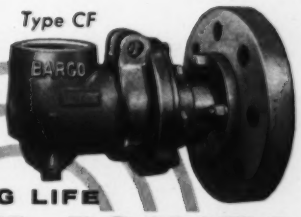
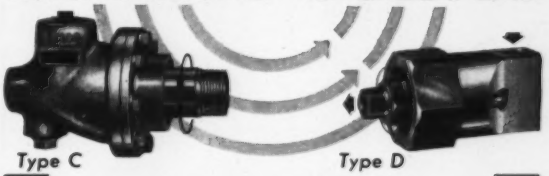



## ROTARY JOINTS



Type C Type D

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Types . . . Sizes . . . Styles for every purpose:

*Type C*—Top performer in industry for dryers, dry cans, rolls, and drums. Threaded ends, ½" to 3". Syphon or single flow. Steam, water, oil, air, gas, or chemicals. Also Type CR for rotating syphon.

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*Series 300*—Large size, up to 2½" x 2½", 300 psi joints for circulating liquids. To 600° F.

*Type CC*—New heavy duty rotary joint for handling shock loads on calender rolls.

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*Write* *Send for latest catalogs.* **BARCO MANUFACTURING CO.**
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*Spherical*

## SHOCK TRAP® for WATER LINES

**Eliminate water hammer and pipeline bursting. Save piping and plant costs with guaranteed surge limits.**

PATENTS PENDING

## PULSCO®

Designed primarily for shut-down or shut-off application, this unit is used in pumping plants, irrigation systems, fire control on rocket test stands, municipal water systems, etc. Of the water interface type, the Pulsco swirl principle reduces pressure and reduces shock and surge resulting from kinetic energy within the pipeline, this by compressing gas within the chamber and by friction through the swirl chamber.

Guaranteed not to recycle, this Pulsco Spherical Shock Trap is built for pressures to 200 PSIG and up. Sizes from 34 to 102 inches diam.

### PULSCO *Venturi* SHOCK TRAP

**For AIRCRAFT and MARINE FUEL LOADING SYSTEMS JET FUEL AND GASOLINE**

Pulsation Controls Corporation was formed with the philosophy in mind of designing engineering specialty items for elimination of Shock and water hammer, the control of pulsations in liquid and gas lines and the abatement of noise caused by vent valves, blowers and other devices.

Pulsco SHOCK TRAP designs are programmed on a digital computer to accurately fit each application to the specific conditions. This new dimension adds accuracy, speed in sizing and prompt service to our customers.

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**Now... basic characteristics of Metal Mold Centrifugal Casting contribute to the reliability of new Lacrosse Missile**

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U. S. Pipe supplies the barrel nozzle in a Cr-Mo-V low alloy steel analysis, heat treated to the following minimums: 95,000 psi tensile strength, 75,000 psi yield strength, and 10% elongation. This alloy is specifically designed to meet exacting military specifications. Various other analyses in carbon, alloy and stainless steel are produced

Centrifugal casting, a direct production approach to quality, is now finding new and increasingly useful applications in rocketry and missile engineering.

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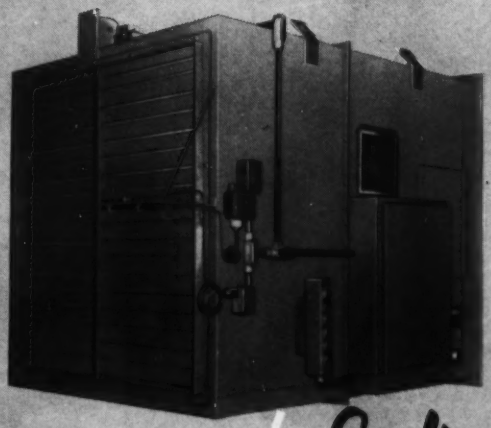

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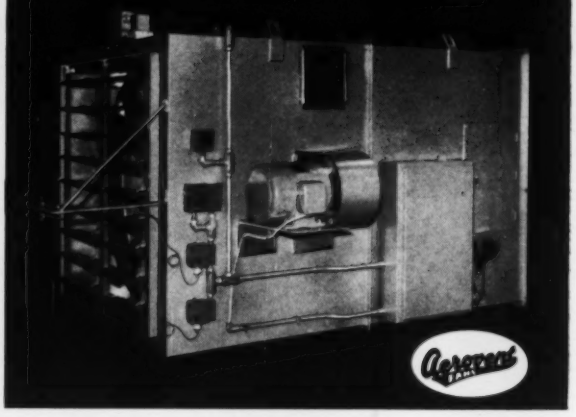


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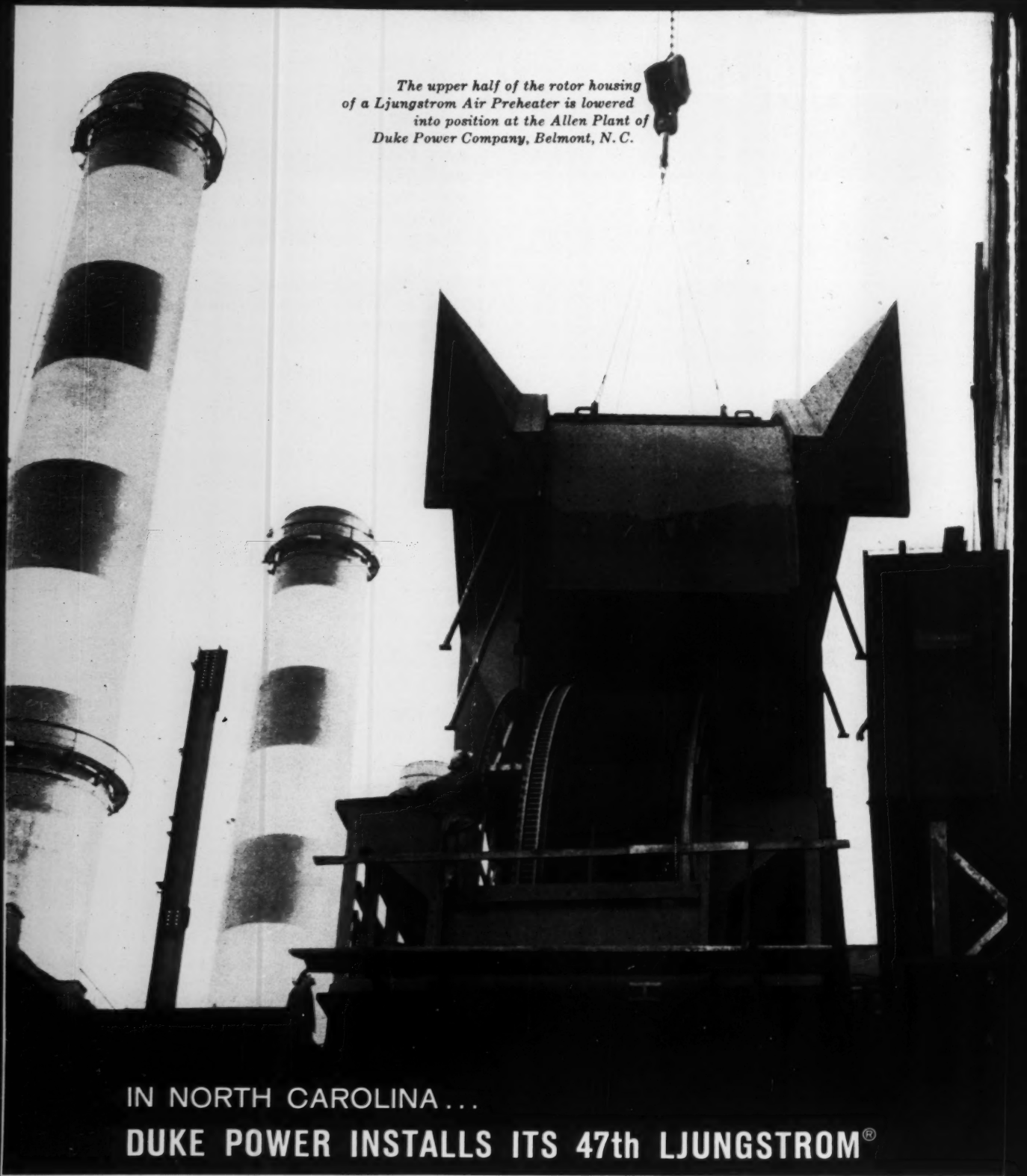

*The upper half of the rotor housing of a Ljungstrom Air Preheater is lowered into position at the Allen Plant of Duke Power Company, Belmont, N. C.*

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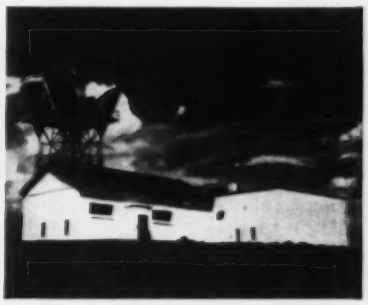
Circle No. 171 on Readers' Service Card

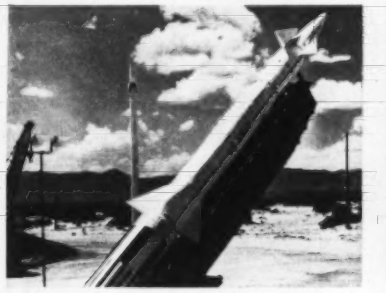
# What was Bell Telephone Laboratories doing
## ON FRIDAY, JUNE 30, 1961?

It was exploring the communications possibilities of the gaseous optical maser – a device which generates continuous coherent infrared radiation in a narrow beam.

It was preparing an experiment in world-wide communications using "active" satellites powered by the solar battery, a Bell Laboratories invention.



It was completing the development of a new "heavy route" Long Distance microwave system capable of handling over 11,000 two-way conversations at once.

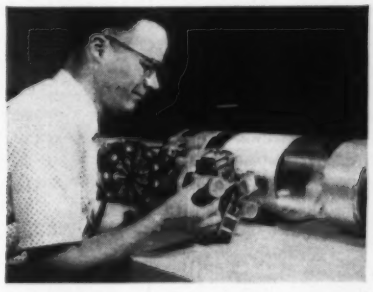


It was developing an anti-missile defense system designed to detect, track, intercept and destroy an enemy ICBM – in a matter of minutes.

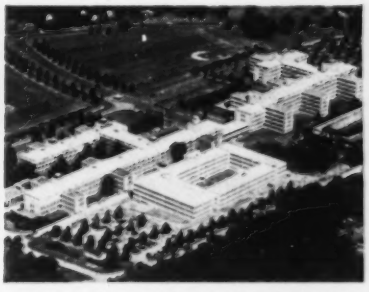
It was demonstrating the potentialities of the superconducting compound of niobium and tin for generating, with little power, magnetic fields of great strength.

It was experimenting with an electronic central office at Morris, Ill., which is capable of providing a wide range of new telephone services.

It was perfecting the card dialer which permits, through insertion of a punched card into a slot, automatic dialing of frequently used numbers.



It was developing improved repeaters or "amplifiers" to increase greatly the capacity and economy of undersea telephone cable systems.



It was continuing its endless search for new knowledge under the leadership of scientists and engineers with world-wide reputations in their chosen fields.

Bell Laboratories scientists and engineers work with every art and science that can benefit communications. Their inquiries range from the ocean floor to outer space, from atomic physics to the design of new telephone sets, from the tiny transistor to massive transcontinental radio systems. The goal is constant—ever-improving Bell System communications services.

**BELL TELEPHONE LABORATORIES**

World center of communications research and development

Circle No. 21 on Readers' Service Card

# INDEX TO ADVERTISERS


Acme Chain Corp. 139
*Aerovent Fan Co. 160
*Air Preheater Corp. 162
Aldrich Pump Co. 34
American Felt Co. 1
Armour Research Foundation 164
*Armstrong Machine Works 14
ASME Publications 148, 169
Mechanical Engineers' Catalog 150
Atlantic Research Corp. 138

*Babcock & Wilcox Co.
Tubular Products Div.,
Fittings Dept. 2nd Cover
Barco Mfg. Co. 157
Bechtel Corp. 163
Bell Telephone Laboratories 167
Bonney Forge & Tool Works 136
*Boston Gear Works 140, 141
Brunswick Corp. 164
Bundy Tubing Co. 23

Carborundum Co. 24, 25, 160
*Combustion Engineering, Inc. 163

DeZurik Corp. 156
*Diamond Power Specialty Corp. 145
Dow Corning Corp. 31
Dresser Industries, Inc.
Pacific Pumps Div. 147
Dwyer, F. W., Mfg. Co. 157

*Flexonics Corp.
Calumet & Hecla, Inc. 21
Flo-Tronics, Inc. 137
Foxboro Co. 27

General Radio Co. 30
Gray Tool Co. 20
Griscom-Russell 151

*Hoffman Industries, Inc.
Air Appliance Div. 7

*Ingersoll-Rand Co. 4
International Business Machines 10, 11

Jeffrey Mfg. Co. 170
Jenkins Bros. 134

*Keeler, E., Co. 19
Kellogg, M. W., Co. 12, 13
*Koppers Co.
Coupling Dept. 18

Lenape Hydraulic Pressing
& Forging Co. 157
Los Alamos Scientific Lab. 165
Lunkenheimer Co. 3rd Cover

*Marsh Instrument Co.
Div. of Colorado Oil & Gas Corp. 32
*Midwest Piping
Div. of Crane Co. 35

Naval Ordnance Laboratory 156
Norwalk Co. 2
Nugent, Wm. W. & Co. 143

Pacific Pumps, Inc.
Div. of Dresser Industries, Inc. 147
Posey Iron Works 137
Powell, William, Co. 161
Pulsation Controls Corp. 157

*SKF Industries, Inc. 33
*Sandusky Foundry & Machine Co. 6
Spraying Systems Co. 144
*Southwest Products Co. 160
Stephens-Adamson Mfg. Co. 28
Stewart, F. W., Corp. 144
Stockham Valves & Fittings 15

*Terry Steam Turbine Co. 146
Thomas Flexible Coupling Co. 138
Timken Roller Bearing Co. 4th Cover
*Tube Turns
Div. of Chemetron Corp. 16, 17

U. S. Electrical Motors, Inc. 155
United States Graphite Co.
Div. Wickes Corp. 8, 9
United States Pipe & Fdry. Co. 158, 159
University of Queensland 164

*Vogt, Henry, Machine Co. 36

*Wheeler, C. H., Mfg. Co. 151
*Wickes Boiler Co.
Div. Wickes Corp. 152
Winsmith, Inc. 22
*Worthington Corp. 149

*Yarnall-Waring Co. 133

*Zallea Brothers 29


## *Advertisers appearing in previous 1961 issues*

ACF Industries, Inc.
W-K-M Div.
Aero Research Instrument Co.
Ajax Flexible Coupling Co.
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American Cast Iron Pipe Co.
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*Buell Engineering Co.
*Byron Jackson Pumps, Inc.
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* The asterisk indicates that firm has product catalog in the 1961 Mechanical Catalog.

***Your attention is directed to***


Keep Informed Section 135–144
Consulting Service 166
Opportunities 163–165
Engrg. Soc. Personnel Service (Agency) 129

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Packing Div.
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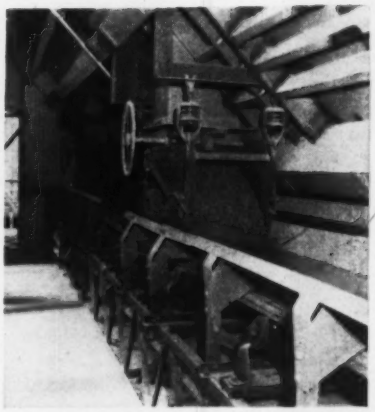
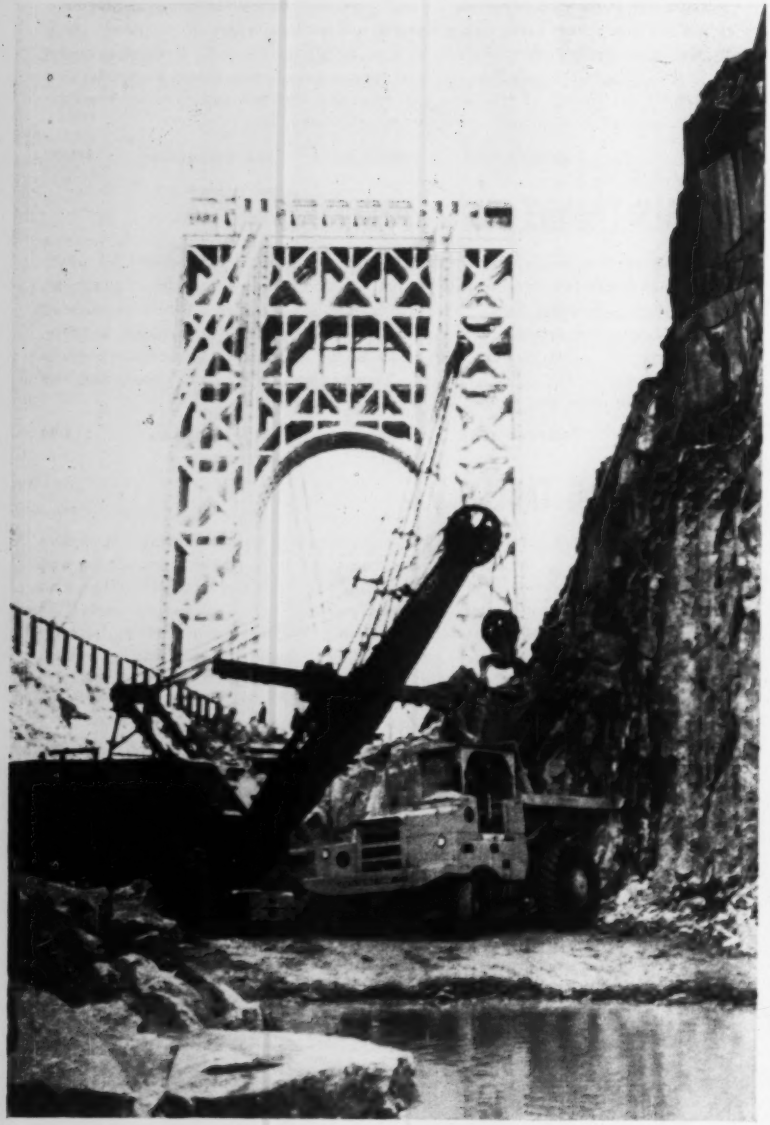


*A group of Jeffrey 3DHS vibrating feeders discharges stone from storage bins to belt conveyor at 100 T.P.H. for recrushing at the Bogota, New Jersey plant of Geo. M. Brewster & Son, Inc.*



SOLVES BOTH A DISPOSAL AND SUPPLY PROBLEM. Stone excavated during preparatory work at bridge is reduced to 8″ minus crushed rock, then hauled to processing plant at Bogota, New Jersey, six miles away, where it is reduced again to aggregate for use in concrete work at bridge site.

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**FIG. 4026N**

Complete Valve with Ends on Casting.
2"-6".
Screwed End.

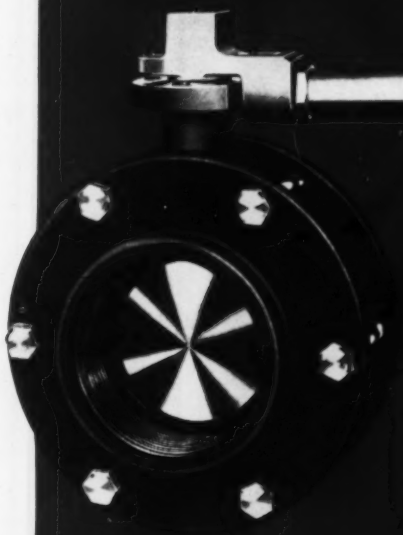

**FIG. 4150N**

(Rubber-Lined: Fig. 4151R) Valve Elements Only.
2"-18". Screwed, Welded, Grooved, or Flanged Ends Supplied Separately to Fit Your Pipe Connections

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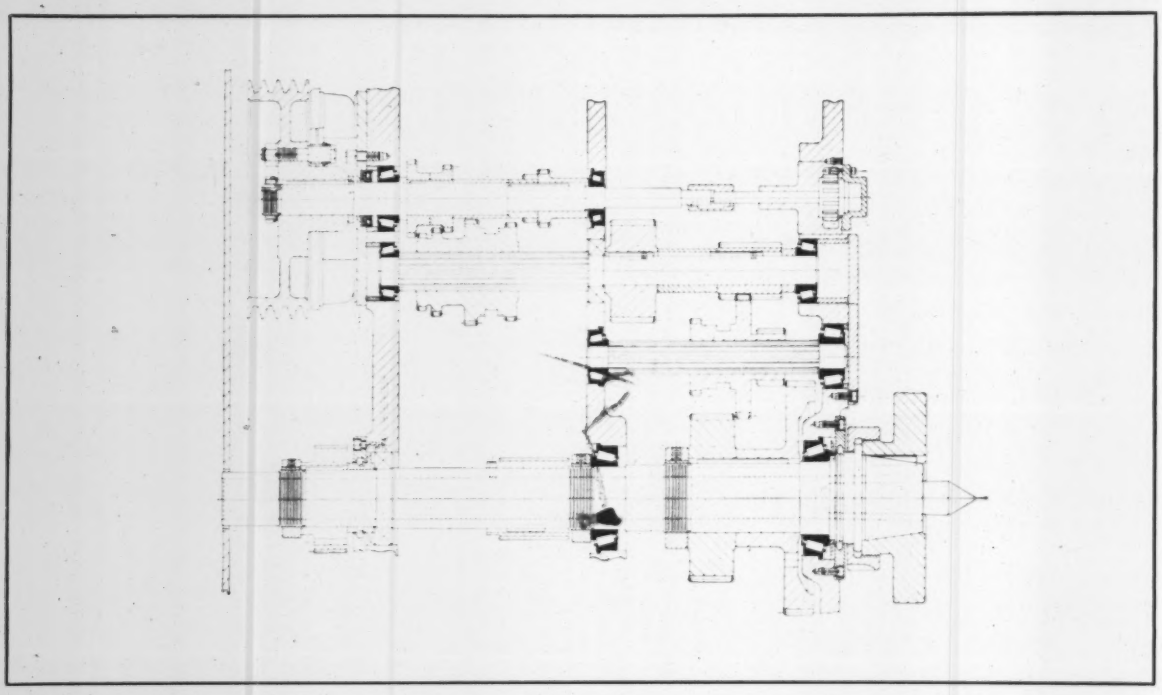

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